4.11.4 Water Use

Livermore Site

The Livermore Site's primary water source is the San Francisco Hetch Hetchy Aqueduct system. This system obtains its water from a reservoir in the Hetch Hetchy Valley of Yosemite National Park. The secondary or emergency water source is the Alameda County Flood and Water Conservation District, Zone 7. This water is a mixture of groundwater and water from the South Bay Aqueduct of the state water project (LLNL 1992a).

In 2002, 1.2 million gallons per day were derived from the Hetch Hetchy Aqueduct and Zone 7 for use at the Livermore Site. Water is primarily used for industrial cooling processes, sanitary systems, and irrigation at the Livermore Site. Minor amounts of water are used for drinking, manufacturing, washing, system filters, boilers, and a swimming pool (LLNL 1992a).

Livermore Site Vicinity

Water for commercial, residential, and agricultural use near the Livermore Site is derived from private wells, Zone 7, city of Livermore wells, and California Water Service Company (CWSC) wells. CWSC has 13 wells in the Livermore area that produce 1,200 million gallons per year, which is augmented by the purchase of 2,200 million gallons per year from Zone 7 Water Service. CWSC water supply serves approximately 54,000 people in the Livermore area.

Figure 4.11.3.4–1 illustrates water supply well locations in the Livermore vicinity. Ten active domestic supply wells are located within one-half mile of the Livermore Site boundary. Well 11H6 is the closest domestic supply well, located just east of Vasco Road.

Two wells within a half-mile of the Livermore Site are used for irrigation used for agriculture (including lawns and gardens) and industrial supply. Of those, well 14B1 is the closest to the Livermore Site, about 200 feet south of East Avenue. The main agricultural groundwater user in the vicinity was the Wente Brothers Winery located southwest of LLNL. Groundwater for the winery is pumped from Well 14C3 during periods of peak water demand. Ten supply wells have been destroyed since the 1990 inventory near the VOC plume in the southwest corner of the Livermore Site.

Site 300

Site 300 draws drinking water from two onsite groundwater production wells in the southeastern part of Site 300. Therefore, water is subject to the *Safe Drinking Water Act* of 1974 regulations (LLNL 2002cc). The system operates under Water Supply Permit No. 03-10-94-001. The system includes a primary drinking water supply well (well 20) and a backup well (well 18), several holding tanks, and a distribution network. Both are deep, high-production wells that can produce up to 23,700 gallons per hour of potable water (LLNL 2003l). Water production from these wells has declined from a peak of 32.7 million gallons in 1992 to 25 million gallons in 2002. LLNL disinfects well water with chlorine and monitors the quality of this water at the well and throughout the distribution system. In addition, the Hazards Control Department reviews the data to ensure that drinking water standards are met. Site 300 Plant Engineering submits the required reports to the California State Department of Health Services (LLNL 2002cc).

In the near future, it is expected that Site 300 will obtain its drinking water from the Hetch Hetchy Aqueduct system. LLNL will maintain the onsite drinking water wells as a backup supply and will be responsible for the Site 300 Drinking Water Permit requirements.

Figure 4.11.3.4–3 shows the groundwater surveillance sampling locations for Site 300. Well VIE2 is located at a private residence 3.7 miles west of the site and represents a typical potable water supply well in the Altamont Hills. One stock watering well (MUL1) and two stock watering springs (MUL2 and VIE1) are adjacent to Site 300 on the north. Eight wells, CARNRW1, CARNRW2, CDF1, CON1, CON2, GALLO1, STONEHAM1, and W35A-04, are adjacent to the site on the south. Seven of these wells are privately owned and were constructed to supply water for drinking, stock watering, and fire suppression. Well W35A-04 was installed for site monitoring purposes only (LLNL 2003l).

4.11.5 Floodplains

Livermore Site

A floodplain is defined as the valley floor adjacent to a streambed or arroyo channel that may be inundated during high water. Arroyo Las Positas and Arroyo Seco are the only potential sources of flooding onsite. Localized flooding is most likely to occur during the rainy season from October to April. Open ditches and storm drains are designed for a 10-year storm event. Most of the Livermore Site ultimately drains to the north into Arroyo Las Positas, and a small percentage of land in the southwest corner drains southward to Arroyo Seco.

The original course of Arroyo Las Positas was through what is now the Livermore Site. In the 1940s, the U.S. Navy diverted the arroyo to its current location. It now approaches the Livermore Site from the east, runs north along the eastern boundary of the Livermore Site for approximately 1,000 feet, then turns west and flows adjacent to the northern boundary of the Livermore Site until it exits the site in the far northwest corner.

Flood insurance studies were performed by the Federal Emergency Management Agency (FEMA) to determine flood hazards in Alameda County and to identify the approximate limits of the 100-year floodplain. These floodplains were incorporated into Flood Insurance Rate Maps (FEMA 1981, FEMA 1997a, FEMA 1997b). Maps depicting the 100-year and 500-year floodplains for the Livermore Site are presented in Appendix F, Figure F.2.1–1.

Arroyo Las Positas is an intermittent stream that drains approximately 3,300 acres in the northeastern and eastern hills above the Livermore Site. Flow has increased in the arroyo over the past several years, due mostly to discharge from the DRB. The additional flow has improved water quality and habitat value (Water KPT 2002). This arroyo has a maximum predicted 100-year base flood peak flow adjacent to the Livermore Site of 822 cubic feet per second (LLNL 1992a). The 100-year floodplain broadens as it approaches the Livermore Site from the east, from 100 feet wide to approximately 800 feet wide, covering Greenville Road along the northeastern boundary of the Livermore Site. The spreading is due to the shallow channel that cannot contain the 100-year flood. As the arroyo flows westward along the northern boundary of the Livermore Site and approaches the northwest corner of the site, the 100-year flood flow exceeds the channel banks to a width of approximately 120 feet. Storm flow within the northern perimeter channel combines with the western area drainage at the northwest corner of the site. The flow is conveyed to the north, beyond the site, within a drainage easement (the north buffer zone) managed and maintained by LLNL. The 500-year floodplain extends approximately 2,000 feet to the north and is generally bounded by the Western Pacific Railroad right of way (Appendix F, Figure F.2.1–1).

After the FEMA studies were complete, the Arroyo Las Positas Maintenance Project was implemented to protect the Livermore Site from the 100-year flood by ensuring that the arroyo would be capable of handling the 10-year storm event and using the north buffer zone as a floodplain for storm events exceeding the capacity of the arroyo. The maintenance project is permitted under several agencies, including the USFWS, the RWQCB, and USACE nationwide permit. A 2-foot-high berm was constructed along portions of the southern bank of the arroyo to ensure that the 100-year flood event would not inundate the Livermore Site. Maintenance activities undertaken to ensure that the channel can handle the 10-year storm event include a 5-year phased project to desilt the 7,000-linear-foot stretch of arroyo on LLNL property, trimming cattail heights, and conducting bank stabilization/erosion control activities (LLNL 2003l).

Arroyo Seco is an intermittent stream that drains approximately 8,960 acres in the foothills to the southeast of the Livermore Site. The channel is narrow and deeply incised where it is present for about 900 linear feet in the far southwest corner of the Livermore Site. It has a 100-year base flood peak flow of 1,200 cubic feet per second that is contained within the channel at the Livermore Site (LLNL 1992a).

Site 300

Site 300 is primarily on undeveloped land characterized by steep hills and deep ravines. A floodplain analysis was conducted for the 1992 LLNL EIS/EIR for this site to determine the depth and width of inundation due to the 100-year storm event. This analysis is summarized in Appendix F.

Based on the results, there are no 100-year floodplains on Site 300 as the 100-year base flood event is contained within all channels. However, due to the steep slopes and high runoff potential, velocities within these channels could be high during a peak flood event.

4.12 NOISE

This section describes ambient noise levels in the environs of LLNL with emphasis on community noise levels in areas where the community may be exposed. Regulations and guidelines related to community noise issues are discussed in Section 4.12.1. Regional noise sources, including those associated with LLNL, are described in Section 4.12.2. Finally, Section 4.12.3 presents the results of local field surveys.

4.12.1 Regulatory Framework

Noise-related criteria and guidelines have been promulgated at the Federal, state, and local level. Various Federal agencies have been delegated responsibility to set noise control standards. Uniform noise control standards have been set by these agencies for equipment such as aircraft and airports, interstate motor carriers and railroads, medium and heavy-duty trucks, motorcycles and mopeds, and portable air compressors. With the exception of federally assisted housing projects, however, community exposures are regulated at either the state or local level, and emphasis is placed on these programs.

4.12.1.1 *State of California*

The State of California has issued land use compatibility criteria for noise elements of local general plans. These guidelines outline the compatibility of various land uses based upon existing community noise levels. They are often adopted by city and county agencies for land use planning purposes and include specific exterior noise exposure standards for commercial, industrial, office, professional, and public recreation land uses. The State of California has also issued community noise equivalent level (CNEL) standards for new multiple-dwelling construction to provide adequate interior protection from exterior noise sources. These standards require a level of protection be incorporated to limit interior noise levels attributable to exterior sources to a level not to exceed 45 A-weighted decibels (dBA)[1] in any habitable room with windows closed. These standards apply to hotels, motels, and dwellings other than detached single-family structures with windows closed, and are included here to provide a standard for comparison, although not specifically applicable.

4.12.1.2 *Local Noise Ordinances*

City of Livermore and Alameda County

The city of Livermore, within the noise element of the general plan, provides acceptable noise levels for certain land uses, based on state guidelines (Table 4.12.1.2–1), and identifies local noise problems and noise-sensitive areas within the city. It further establishes goals to be achieved in noise abatement and identifies a basic framework for implementing a noise-control program. Several elements of the city general plan are currently being updated. In the update, the city identifies noise levels compatible with various land uses to guide future mitigation of noise

---

[1] Sound is often expressed using the decibel (dB) scale. The decibel scale is a nonlinear scale of measurement that simplifies presentation data that have a wide range of variation, but its values cannot be added together without conversion; i.e., 1 dB + 1 dB does not equal 2 dB. The A-weighted decibel (dBA) scale is an instrument response that mimics the human ear at moderate sound pressure levels. The CNEL represents a time-weighted, 24-hour average noise level based on the A-weighted decibel scale. “Time-weighted” refers to the fact that noise that occurs during certain sensitive times is weighted more heavily in calculations. This scale includes a 5-decibel upward adjustment for sounds occurring in the evening (defined as 7 p.m. to 10 p.m.) and a 10-decibel upward adjustment for sounds occurring in the late evening and early morning (defined as 10 p.m. to 7 a.m.).

issues. The city also addresses noise considerations in its municipal code noise ordinance. This ordinance is intended to reduce and restrict certain noise-generating activities within its jurisdiction and provides methods for addressing noise problems, but it does not contain explicit noise level limits.

The Alameda County general plan noise element is similar to that of the city of Livermore. Noise criteria are also included in the East (Alameda) County Area Plan (ECAP). The goals contained in these two plans are generally more stringent than those set in the city's noise ordinance. In addition, the ECAP addresses potential impacts of proposed activities, characterized by a net increase in dBA. The County's noise element also sets limits on the allowable amount of noise (maximum decibels) that can be heard from one property to another to protect certain noise-sensitive land uses (City of Livermore and LSA 2002).

TABLE 4.12.1.2–1.—*City of Livermore Land-Use Compatibility for Community Noise Environments, Day-Night Average Levels* [a]

Land Use	Normally Acceptable Levels (dBA)	
	City	County
Residential – low density	< 60	50 – 60
Residential – multi-family, and transient lodging	< 65	50 – 65
School, library, church, playground, park	< 70	50 – 70
Golf course, water recreation	< 75	50 – 75
Office building	< 70	-
Industrial, manufacturing, agricultural	< 75	-

Source: City of Livermore and LSA 2002.
[a] The *Day-Night Average Level* is a time-weighted average noise level wherein the individual "pockets" of noise that occur during late evening through early morning (10 p.m. to 7 a.m.) are multiplied by 10 (i.e., given a 10-decibel upward adjustment) to account for the fact that certain noises would be more objectionable and the community is more sensitive to noises that occur during these times.
dBA = A-weighted decibels.

City of Tracy and San Joaquin County

The city of Tracy's noise control ordinance was established to reduce and restrict certain noise-generating activities and provide methods for addressing noise problems. Unlike Livermore, however, it provides explicit noise level limits for various zoning types (Table 4.12.1.2–2) and requirements for exemptions to the ordinance.

San Joaquin County has adopted a noise ordinance (Section 9-1025.9 of the San Joaquin County Code - Development Title [San Joaquin County Code 2002]) which stipulates maximum allowable noise exposure levels associated with proposed activities. A proposed project that will create new stationary noise sources, or expand existing noise sources, is required to mitigate noise level so that the hourly equivalent noise level (Leq) in outdoor activity areas not exceed 45 dB during the nighttime (10 p.m. to 7 a.m.) and 50 dB during other periods. Maximum noise levels are restricted to 65 dB during nighttime and 70 dB for day and evening hours. The ordinance also stipulates that these levels be reduced by 5 dB for impulsive and single tone noise. For transportation projects, a 45 dB day-night average level is established as the maximum allowable noise exposure for interior spaces, and 65 dB for outdoor activity areas. The ordinance exempts noise sources associated with construction occurring within the 6 a.m. to 9 p.m. period on any day, and any activity whose regulation has been preempted by state or Federal law.

TABLE 4.12.1.2–2.—*City of Tracy Sound Level Limits for Base District Zones*

Base District Zone	Sound Level (dBA)
Residential districts	55
Commercial districts	65
Industrial districts (light and heavy)	75
Agricultural	75
Aggregate mineral overlay zone	75

Source: City of Tracy 2002.
dBA = A-weighted decibels.

For comparative purposes, typical indoor and outdoor noise levels generated by various activities are listed in Table 4.12.1.2–3.

TABLE 4.12.1.2–3.—*Typical Sound Levels*

Noise Source	Sound Level (dBA)
Near jet engine	140
Accelerating motorcycle at a few feet away	110
Pile driver; noisy urban street/heavy city traffic	100
Ambulance siren; food blender	95
Pneumatic drill; vacuum cleaner	80
Near freeway auto traffic	70
Suburban street	55
Light traffic; soft radio music in apartment	50
Average residence without stereo playing	40
Soft whisper	30

Source: City of Livermore and LSA 2002.
dBA = A-weighted decibels.

4.12.2 Environmental Setting and Existing Noise Sources

This section provides a description of local noise sources and sources attributable to LLNL and presents the results of local noise monitoring surveys.

4.12.2.1 *Local Noise Sources*

Noise sources local to Livermore include the following (City of Livermore and LSA 2002):

- **Construction Activity—**Construction generally comprises discrete steps, including demolishing, excavating, grading, and building, resulting in intermittent noise levels generally higher than background. Each of these steps involves different equipment and, consequently, its own noise characteristics. Typical noise levels can reach 90 decibels or more at 50 feet during the noisiest construction phases. Mitigation is typically required to reduce the impact of construction activity noise on the surrounding community. The city of Livermore requires that all construction vehicles or equipment be equipped with properly operating and maintained mufflers. For certain equipment, hours of operation are restricted to between 7 a.m. and 8 p.m.

- **Equipment—**The variety of machinery or equipment that generates noise during operation includes heating, ventilating, and air-conditioning equipment, cooling towers, motors, pumps, fans, generators, air compressors, jackhammers, and loudspeakers.

- **Vehicular Traffic—**Traffic noise varies depending on factors such as traffic volume, vehicle mix (percentage of cars and trucks), and average traffic speed. Major regional roadway noise sources include I-580, Highway 84, Livermore Avenue, First Street, and other arterial and collector roadways throughout the city.

- **Rail Operations—**The Union Pacific and Southern Pacific rail lines, located just north of the Livermore Site, produce noise from whistles, engines, and wheels and ground-borne vibration.
- **Aircraft Operations—**The Livermore Airport, located south of I-580 just within the western boundary of the city of Livermore, provides a variety of services to small and large noncommercial aircraft. It is a source of intermittent noise associated with takeoffs, landings, taxiing, and support vehicles. Aircraft overflights, however, currently contribute little to the ambient noise levels in Livermore.

Local noise sources in the Site 300 environs include off-road vehicles using the Carnegie State Vehicular Recreation Area south of Site 300, vehicular traffic along Corral Hollow Road, and occasional aircraft flybys. The city of Tracy Municipal Airport is somewhat distant and a relatively minor source of noise.

4.12.2.2 *Noise Sources Associated with Lawrence Livermore National Laboratory Activities*

Noise sources at LLNL are, for the most part, common to other local industrial/commercial settings, although on a somewhat larger scale. Construction and demolition activities are similar, however, because of the size of the site, perimeter buffer zone, and intervening roads. The contribution of these activities to noise levels offsite is small. The contribution of mobile noise sources associated with heavy-duty trucks and employee vehicles is greater, due to the relatively large number of shipments of materials and waste to and from the site and the large employment base; i.e., compared with other area businesses. Occasionally, noise may also be heard from the pistol and rifle firing range located at Site 300. These activities are not in conflict with land use compatibility guidelines.

LLNL is somewhat unique in the category of impulse (short-blast) noise associated with explosives research testing. High explosive tests are conducted regularly (daily and/or weekly) at both the Livermore Site, in the High Explosives Application Facility (HEAF), Building 191; and at Site 300, within the Contained Firing Facility and on open firing tables.

Although impulse noise associated with new stationary source activities is now regulated by San Joaquin County Ordinance 9-1025.0, this category of noise has not historically been considered within most local agency land use compatibility guidelines. In 1991, LLNL evaluated this type of noise and, in an effort to limit nuisance to nearby residents and preclude damage to property, imposes a maximum allowable sound pressure level of 126 decibels, not to be exceeded in nearby populated areas. This value is considerably lower than some known damage thresholds and is considered to be well within the safe limit for both humans and structures in residential areas (LLNL 1991a). LLNL uses "blast forecasting" for open air detonations at Site 300. Blast forecasting considers explosive type and detonation characteristics together with various sound-wave propagation factors such as atmospheric attenuation, local topography, ground surface roughness, and monitored meteorological conditions to predict the magnitude and location of impulse noise levels. Blast forecasting is used to determine the maximum explosive weight that can be detonated without an irritant effect on the nearest populated areas; i.e., maintains sound levels within the self-imposed 126-decibel limit. Prior to tests on the open firing tables, LLNL also launches a weather balloon to obtain more detailed input data for the predictive noise-modeling program.

At the Livermore Site, explosive tests are conducted within the HEAF Building and, although these may at times be audible offsite, the insulating properties limit noise levels in nearby populated areas to a small fraction of the self-imposed 126-decibel limit.

4.12.3 Noise Monitoring Surveys

A field survey was conducted in January 2003 to characterize typical daily maximum noise levels in the vicinity of the Livermore Site (Sculley 2003). Measurements were taken for 1-hour periods using standard sound-level meters during the heart of the morning and evening commute. The monitors were placed at eight locations surrounding and just outside the Livermore Site perimeter, in regions of maximum activity (intersections and site entrance and exit locations) shown in Figure 4.12.3–1. Results of the survey, listed in Table 4.12.3–1, indicated that, as expected, vehicular traffic was the dominant noise source at most monitored locations. Rail operations and light aircraft overflights were minor contributors. The only recognizable noise sources from site activities within LLNL were some heavy equipment backup warning beepers, which were detectable during low traffic intervals at the monitoring sites on Patterson Pass Road. All levels were within the acceptable range established by the city of Livermore and Alameda County.

In addition to the 1-hour monitoring activity, additional measurements were taken to characterize the variations in noise over a 24-hour period. These measurements were taken along Vasco Road, approximately 1,000 feet south of Patterson Pass Road. The results indicated noise levels typical of suburban and near-freeway streets, with highest levels occurring during periods corresponding to peak traffic hours (Figure 4.12.3–2).

In 1991, a less extensive field survey, consisting of 5 perimeter locations and 10- to 15-minute collection periods, was conducted in the vicinity of Site 300 to document weekday ambient noise levels. The study showed ambient noise levels along Corral Hollow Road/Tesla Road ranging from 56 to 66 dBA equivalent continuous sound level (L_{eq})[2], which is typical of traffic noises associated with suburban street to near-freeway traffic (Table 4.12.3–2). At the time of the survey, no noticeable noise was being generated at the Site 300 firing range or the Carnegie State Vehicular Recreation Area. Higher ambient noise levels would be expected at the monitoring sites along Corral Hollow Road/Tesla Road during weekend periods when the Carnegie State Vehicular Recreation Area has the greatest off-highway vehicle activity.

[2] The *Equivalent-Continuous Sound Level* (L_{eq}) is an energy-averaged noise level for the indicated time.

TABLE 4.12.3–1.—*Results of Ambient Noise Measurements Around Livermore Site*[a]

Locations [b]	Date	Start and End Times [c]		1-Hour L_{eq} [d] (dBA)
1 Patterson Pass Rd: 16 ft from near traffic lane	Jan. 9, 2003	7:00 -	8:00 a.m.	70.5
		4:30 -	5:30 p.m.	68.5
2 Patterson Pass Rd: 19 ft from near traffic lane	Jan. 9, 2003	7:00 -	8:00 a.m.	68.1
		4:30 -	5:30 p.m.	63.7
3 Greenville Rd: 6.8 ft from near traffic lane	Jan. 7, 2003	7:15 -	8:15 a.m.	73.0
		4:30 -	5:30 p.m.	74.0
4 Vasco Rd: 17 ft from near traffic lane	Jan. 8, 2003	7:00 -	8:00 a.m.	70.2
		4:30 -	5:30 p.m.	68.6
	Jan. 9, 2003 [e]	7:00 -	8:00 a.m.	70.2
5 Vasco Rd: 32 ft from near traffic lane	Jan. 10, 2003	7:15 -	8:15 a.m.	73.2
		4:30 -	5:30 p.m.	66.5
6 Vasco Rd: 43 ft from near traffic lane	Jan. 10, 2003	7:15 -	8:15 a.m.	73.4
		4:30 -	5:30 p.m.	69.3
7 Greenville Rd: 21 ft from near traffic lane	Jan. 7, 2003	7:00 -	8:00 a.m.	72.2
		4:30 -	5:30 p.m.	73.5
8 Greenville Rd: 11 ft from near traffic lane	Jan. 8, 2003	7:00 -	8:00 a.m.	72.3
		4:30 -	5:30 p.m.	72.6

Source: Sculley 2003.

[a] Monitoring was conducted using Larson-Davis Model 820 Type I sound level meters mounted on tripods, about 4 to 5 feet aboveground level. Instruments have a 110-decibel dynamic range with a noise floor of about 20 dBA. Meters were programmed for slow response (8 samples per second, 1 second averaging), A-weighted setting. Weather protection for the body of the meter was provided as necessary using plastic bags or vinyl pouches.

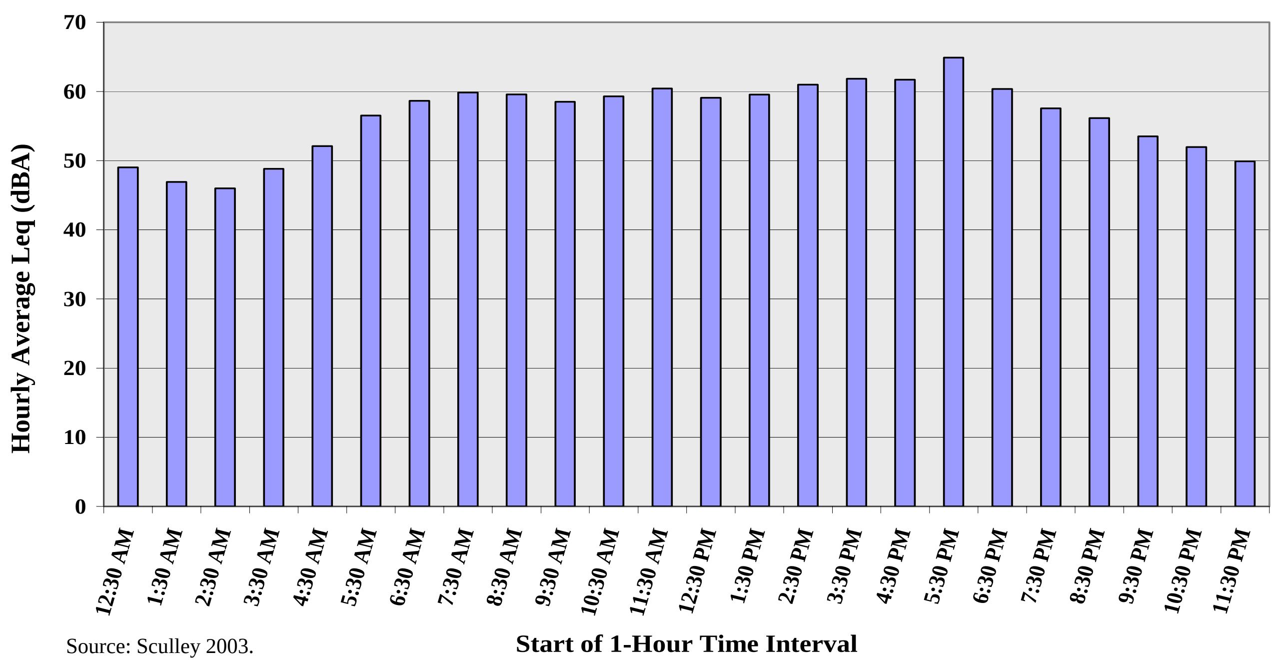
[b] Locations are shown on Figure 4.12.3–1.

[c] Meters were started and stopped manually, with 1-minute time histories and 15-minute interval histories collected; interval histories were synchronized to clock hours.

[d] The *Equivalent-Continuous Sound Level* (L_{eq}) is an energy-averaged noise level for the indicated time.

[e] Morning noise monitoring at Station # 4 was repeated on January 9, 2003.

dBA = A-weighted decibels



Source: Sculley 2003.

FIGURE 4.12.3–2.—*Hourly Average Noise Levels Along South Vasco Road*

TABLE 4.12.3–2.—*Lawrence Livermore National Laboratory Site 300 Offsite Ambient Noise Measurement Results*

Approximate Location	Time	L_{eq} [a] (dBA)	Description
Along eastern Site 300 boundary	11:15 - 11:30 AM	59	No dominant noise sources
Next to Corral Hollow Road			Ambient noise dominated by
0.75 mile west of I-580	9:05 - 9:20 AM	60	Earth-moving equipment (operating at Corral Hollow landfill, 0.5 mile from monitor)
2 miles east of I-580	9:35 - 9:50 AM	56	Overflying hawk
Across from Carnegie State Vehicular Recreational Area	12:50 - 1:05 PM	66	Wind and a few vehicles on roadway
Next to Tesla Road			Ambient noise dominated by
0.5 mile west of Alameda/San Joaquin County Line	1:15 - 1:30 PM	64	Wind and a few vehicles on roadway

[a] The *Equivalent-Continuous Sound Level* (L_{eq}) is an energy-averaged noise level for the indicated time.
dBA = A-weighted decibels.

4.13 TRAFFIC AND TRANSPORTATION

4.13.1 Regional and Local Circulation System

Livermore Site

Regional access to the Livermore Site by motor vehicle is from I-580, which runs east and west approximately 1 mile north of the Livermore Site. As depicted in Figure 4.13.1–1, the Vasco Road/I-580 interchange provides access to the western site boundary, and the Greenville Road/I-580 interchange provides access to the eastern site boundary.

Approximately 35 percent of the Livermore Site employees live within 12 miles of the Laboratory (LLNL 2001d). The remaining employees come to work from greater distances, mostly from the counties of Alameda, San Joaquin, Contra Costa, and Stanislaus. Many of these commuters travel in personal vehicles and arrive either on local roads or on I-580. Alternate modes of commuter transportation, such as carpools, vanpools, bicycles, or public transit, are described in Section 4.13.6. Trucks carrying radioactive or hazardous material shipments almost exclusively arrive from or depart to the east on I-580 and I-5, except for local deliveries from the Bay Area.

Site 300

Regional access to Site 300 is from I-580 to Corral Hollow Road. Alternately, travel between the Livermore Site and Site 300 is by way of Tesla Road as shown in Figure 4.13.1–1. Tesla Road changes to Corral Hollow Road at the Alameda-San Joaquin county line. There is one primary access gate to Site 300 from Corral Hollow Road plus another gate for the pistol range.

4.13.2 Local Traffic Conditions and Issues

Livermore Site

Traffic Conditions

The major street system in the vicinity of LLNL includes I-580, South Vasco Road, Greenville Road, East Avenue, and Patterson Pass Road. Most of these are primarily located in the city of Livermore, but with portions of all streets lying in unincorporated portions of Alameda County. Figure 4.13.1–1 shows a vicinity map and existing daily traffic volumes.

I-580 is a major east-west freeway in the vicinity of the Livermore Site. This roadway is a connector freeway between I-5, which extends the entire length of California, and I-80, the major freeway in the San Francisco/Oakland area. I-580 is an eight-lane roadway from east of the Altamont Pass near Livermore to the I-80 complex. I-580 also continues over the Richmond-San Rafael Bridge to connect with Highway 101 in Marin County. In the Livermore vicinity, I-580 carries approximately 120,000 vehicles per day with about 10.4 percent trucks. I-580 experiences significant congestion during extended peak commute hours in the morning; the westbound lanes experience congestion in the Vasco Road/Greenville Road area (and beyond). In the evening, the eastbound lanes are congested from west of I-680 on the west to the Altamont Pass and eastward. Because of the congestion on I-580, the three parallel roads that connect the Tri-Valley area with the San Joaquin Valley—Patterson Pass Road, Tesla Road, and Altamont Pass Road—are increasingly used by commuters.

South Vasco Road is an important north-south roadway with four to six lanes and a median between East Avenue and I-580, with a continuation north of I-580. This roadway serves as a major route for traffic to LLNL, with an estimated 36 percent of all traffic accessing the site by way of South Vasco Road (LLNL 2002be). South Vasco Road connects to I-580 with an interchange that will require upgrading in the future. Daily traffic volumes average 30,000 vehicles per day between I-580 and Las Positas Road, 26,200 vehicles per day between Las Positas Road and Patterson Pass Road, and 16,600 vehicles per day between Patterson Pass Road and East Avenue along the western border of the Livermore Site. South Vasco Road has a grade-separated over-crossing of the Union Pacific Railroad, located between Brisa Street and Patterson Pass Road, and an at-grade crossing of a different, lightly used, Union Pacific Railroad track north of Brisa Street. This crossing is protected with crossing gates. South Vasco Road has existing traffic signals at seven of the nine intersections between I-580 and East Avenue (Industrial Way, Las Positas Road, Brisa Street, Patterson Pass Road, Daphne Drive/Westgate Drive, Emily Way/Mesquite Way, and East Avenue). The South Vasco Road intersections with Preston Avenue and Naylor Avenue do not have traffic signals. In addition to serving the Livermore Site and existing residential districts west of the Livermore Site, South Vasco Road provides key access to the large industrial/business parks located north of the area extending from Greenville Road to west of South Vasco Road. South Vasco Road also provides access to the existing Altamont Commuter Express (ACE) (see Section 4.13.6) commute train station located near the southwest quadrant of the intersection of South Vasco Road and Brisa Street. The northern section of South Vasco Road, generally between I-580 and Las Positas Road, experiences the greatest degree of congestion in this corridor due to higher traffic volumes and a greater density of intersections with traffic signals.

Greenville Road is the other north-south roadway serving the Livermore Site. Portions of Greenville Road are two, three, four, and six lanes wide, with the wider sections to the north. Ultimately, Greenville Road is expected to be six lanes wide with a median north of National Drive and four lanes wide with a median between National Drive and East Avenue. (As noted elsewhere, the city of Livermore is currently updating its general plan and its circulation element, which may result in new ultimate descriptions of all major streets in the city). Traffic volumes on Greenville Road vary from 15,600 vehicles per day near Southfront Road to 12,000 vehicles per day near Patterson Pass Road. It is estimated that 21 percent of all Livermore Site traffic uses Greenville Road for access (LLNL 2002be).

Greenville Road has a split interchange with I-580. The westbound ramps on the north side of I-580 form a buttonhook interchange with Northfront Road. The eastbound ramps on the south side of I-580 form a buttonhook interchange with Southfront Road. Both buttonhook intersections are controlled with stop signs. Greenville Road passes beneath I-580 and forms the connection between Northfront Road and Southfront Road, to complete the interchange. The interchange will be upgraded and modified in the future, but there are no projects scheduled at this time.

There are nine public street intersections with Greenville Road between Northfront Road and East Avenue. Four of these intersections have traffic signals (Southfront Road, Las Positas Road, National Drive, and Lupin Way/Eastgate Drive). The intersections without signals are Northfront Road, Hawthorne Avenue, Marathon Drive, Patterson Pass Road, and East Avenue. Greenville Road has an antiquated grade separation of the Union Pacific Railroad located between National Drive and Marathon Drive. The railroad passes over the roadway, which is at grade. The portion of Greenville Road below the railroad overpass is a narrow two-lane section on reversing curves. This grade separation and about 600 feet of roadway will be upgraded to modern standards within the next 2 years in a project sponsored by the city of Livermore.

Greenville Road connects with Tesla Road south of East Avenue. In this area, Greenville Road is a straight, two-lane roadway traveling through rolling terrain. It has an estimated traffic volume of 3,000 vehicles per day.

East Avenue is the major east-west roadway serving the Livermore Site. An estimated 43 percent of all Livermore Site traffic uses East Avenue for access (LLNL 2002be). The western half of the section of East Avenue between South Vasco Road and Greenville Road is four lanes wide, and the eastern half has two lanes. This roadway was closed and gated in 2003 and will not be usable for non-Livermore Site or SNL/CA traffic. (See a description of this proposed change under “Relevant Transportation Issues” in this section.) The daily two-way traffic on this section of East Avenue is about 10,350 vehicles per day east of South Vasco Road and about 3,200 vehicles per day west of Greenville Road. According to a recent traffic study (Korve 1999), only about 2 percent of all traffic on this roadway was not related to the Livermore Site or SNL/CA.

West of South Vasco Road, East Avenue serves as an arterial road linking predominately residential land uses abutting the East Avenue corridor, with downtown uses to the west and Livermore Site/industrial uses to the east. East Avenue is generally a five-lane roadway with the fifth lane serving left turn movements. East Avenue extends approximately 2.5 miles westerly to South Livermore Avenue. There are traffic signals at the East Avenue/South Vasco Road intersections as well as along East Avenue at the intersections of Charlotte Way, North Mines Road, Loyola Way, Madison Avenue, Hillcrest Avenue, Dolores Street, and South Livermore Avenue. The daily traffic volume on East Avenue, west of South Vasco Road, is approximately 12,500 vehicles per day.

Patterson Pass Road is a four-lane divided highway between South Vasco Road and Greenville Road, located just north of the Livermore Site. Industrial buildings occupy the north side of the street; the south side of the street is an undeveloped buffer for the Livermore Site. Patterson Pass Road carries about 6,200 vehicles per day. The Patterson Pass Road intersection with South Vasco Road has a traffic signal and the Greenville Road intersection is controlled by stop signs.

West of South Vasco Road, Patterson Pass Road extends about 1.5 miles to North Mines Road, which has a connection to First Street since a railroad overpass was constructed in 1999. The Patterson Pass Road/North Mines Road system provides access to a major residential portion of Livermore and also provides an additional route for employees to reach the Livermore Site.

East of Greenville Road, Patterson Pass Road extends about 10.5 miles east to an interchange with I-580 on the west side of the city of Tracy. In this section, Patterson Pass Road is a winding two-lane roadway with no paved shoulders. Due to congestion on I-580 through the Altamont Pass, Patterson Pass Road is receiving increased usage during commute periods. The current traffic volumes are estimated at 3,500 vehicles per day. East and north of the I-580 interchange, Patterson Pass Road changes its name to Mountain House Parkway, which extends as a north-south roadway into the newly developing community of Mountain House, located on the north side of I-205.

Relevant Transportation Issues

City of Livermore General Plan Update

The city of Livermore is currently updating its general plan. Two general plan issues that relate to transportation are land use and circulation. Livermore has had its update process underway since April 2002, and the schedule calls for completion of the process by September 2003.

The city of Livermore has made some interim land use decisions that could be a precursor to the direction the final general plan update will take. At a December 2002 meeting, the city council decided to take action that would establish an urban limit line around the borders of the city. The urban limit line on the east side of the community generally would follow the boundary of Greenville Road. This boundary would preclude any residential-, employment-, or transportation-related developments that had been contemplated east of Greenville Road, between Southfront Road and the Livermore Site. With the placement of the growth boundary, this land would not be immediately available for LLNL-related uses and their associated traffic impacts. The same urban limit line has been drawn to preclude any major residential development in north Livermore, north of I-580. A proposal to develop up to 12,500 homes with a related population of about 30,000 would be precluded by the adoption of the urban limit line as proposed.

The circulation element is also being updated. The city of Livermore is developing a major traffic model to forecast the traffic volumes and impacts resulting from various land use proposals that will be considered as part of the process. The circulation element may change the function of any of the major streets described above, although it is not likely that this process will change the role and function of South Vasco Road, Greenville Road, East Avenue, Patterson Pass Road, or Tesla Road. The updated traffic model will be able to determine if ultimate widths of these and other major streets should be adjusted from earlier plans.

Road Improvements Near the Livermore Site

The city of Livermore is contemplating the update of the Vasco Road/I-580 interchange. The interchange would be improved in stages, and the first stage would be to modify and install signals on the eastbound ramps. Signals would also be added to Preston Avenue. The net effect of the first stage would be to improve the capacity and safety of the south side of the interchange by removing the loop off-ramp and replacing it with a ramp with traffic signals located closer to I-580. This would reduce the speed of traffic exiting the freeway and increase the distance between Preston Avenue and the I-580 off-ramp. Later improvements would improve the ramps on the north side of the interchange. The first stage is scheduled for 2005 although, because of budget limitations, the actual construction could be delayed.

The city of Livermore is planning to construct improvements on Greenville Road near the Union Pacific Railroad structure south of National Drive. In this area, the roadway is a narrow two lanes and has reversing curves in the railroad area. The roadway will be straightened and widened to four lanes. The total project length is about 600 feet. The work was scheduled to start in 2003.

Security Upgrade of East Avenue at the Livermore Site

LLNL and SNL/CA have conducted studies to close East Avenue as a public street between South Vasco Road and Greenville Road. Although this closure was identified in the 1992 LLNL EIS/EIR, heightened security at the Nation's government facilities has prompted a re-examination of this closure, which has been evaluated in an environmental assessment (EA) (DOE 2002i, DOE 2002h) and is part of the No Action Alternative in this SWEIS. In 2003, DOE placed this East Avenue segment under administrative control and constructed security checkpoints at both ends of the segment. A truck inspection station would be built west of the Greenville Road intersection. Because only two percent of the existing traffic on East Avenue is not LLNL- and SNL/CA-related, closure of the road to public traffic would have very minimal impacts on the surrounding street system.

During 2002, both the city of Livermore City Council and the Alameda County Board of Supervisors vacated easement rights on East Avenue in the subject area, in effect removing it as a public street. Construction of the security checkpoints or other recommended street and system modifications commenced in May 2003.

Bay Area Rapid Transit District to Livermore Studies

The Bay Area Rapid Transit District (BART) (see Section 4.13.6) and the Alameda County Congestion Management Agency are co-sponsoring a study of a potential BART extension from its current terminus at the Pleasanton/Dublin Station to stations in Livermore. The two previously identified station locations in Livermore are in the I-580 corridor near Isabel Avenue and near Greenville Road. BART owns property at both locations. Although the study recommendations confirmed the alignment and station locations previously identified, additional studies are currently taking place to analyze the potential for use of the Union Pacific Railroad Corridor through downtown Livermore, using diesel-powered train units. The current studies are being considered as interim, more affordable, solutions to the BART extension issue. The Union Pacific Corridor is located only a few hundred feet north of the Livermore Site near Patterson Pass Road, so additional commuter facilities on this line (now serving the ACE) would provide improved commute opportunities to LLNL employees.

Funds are available for preliminary engineering of the selected alternatives, but full funding of the extension is not currently available. The construction cost for the range of alternatives is about $500 million to $1 billion. The BART to Livermore studies are anticipated to continue beyond 2003.

I-580 Improvements

The California Department of Transportation is conducting a study to determine the details of a plan to construct high-occupancy vehicle (HOV) lanes on I-580 between Santa Rita/Tassajara Roads and Greenville Road. The HOV lanes project is estimated to cost between $100 million and $200 million and is not yet fully funded. The I-580 study is also examining ways to stage the project so that available funds can be used to construct feasible pieces of the ultimate project. The HOV lanes are expected to help reduce the prevailing commute-period congestion on I-580 between Pleasanton and the Altamont Pass.

Site 300

Traffic Conditions

Tesla Road is an east-west arterial highway located one mile south of the Livermore Site. The name of the road changes to Corral Hollow Road at the boundary between Alameda County and San Joaquin County near the western end of Site 300. The access for Site 300 is located on Corral Hollow Road, 13.1 miles east of Greenville Road. Between Site 300 and Greenville Road, the daily traffic on Tesla Road averages approximately 4,500 vehicles per day. In this area, Tesla Road is a winding two-lane roadway with no paved shoulders; the terrain is rolling. Posted speed limits range from 45 to 55 miles per hour in the vicinity of Site 300. East of the Site 300 access, Corral Hollow Road continues as a two-lane winding roadway, 4.1 miles to an interchange with I-580 south of the city of Tracy. Tesla Road is receiving increased usage during commute periods because of congestion on I-580 through the Altamont Pass.

Relevant Transportation Issues

Altamont Corridor Improvements

The cities of Tracy and Livermore and Alameda County have formed a joint powers authority to expend transportation impact fees collected from the developers of the Tracy Hills project in the city of Tracy. Although the Tracy Hills development has not yet commenced, its developers will be required to contribute $1,500 per residential unit to help solve regional transportation issues in

San Joaquin and Alameda counties. A study is underway to determine the most effective way to spend these funds.

City of Tracy/San Joaquin County Plans

The California Department of Transportation is planning to improve I-205 between Eleventh Street in Tracy and I-5 near Lathrop. This project will widen the freeway from four lanes to six lanes and is scheduled to begin construction in 2004.

4.13.3 Traffic and Transportation Accident History

NNSA reviewed the California Statewide Integrated Traffic Records System accident reports for 1999, 2000, and 2001. The information was for all streets near the Livermore Site and Site 300 and included South Vasco Road, Greenville Road, Patterson Pass Road, East Avenue, and Tesla Road. The accidents are summarized in Table 4.13.3–1.

The accident rates on the main roads serving the Livermore Site are also compared with the average accident rates for similar roads in the State of California. Average accident rates in California on urban four-lane divided roadways are 2.18 accidents per million vehicle miles (MVM). For two- and three-lane urban roadways, the average rate is 1.93 accidents per MVM. For two-lane rural roadways, the average rate is 1.21 accidents per MVM.

Two of the 10 sections analyzed have accident rates above the statewide average. Both sections are on South Vasco Road between I-580 and Patterson Pass Road. The accident rates on the two sections within these limits are 2.48 and 2.43, about 114 and 111 percent, respectively, of the statewide rates. On these two sections, the roadway volumes are high, ranging from 26,200 vehicles per day to 30,000 vehicles per day. In the first section, the city of Livermore is planning to install traffic signals at Preston Road and improve the I-580 interchange, which should reduce the accident rate. In the next section to the south, traffic signals and street improvements have been made recently that should improve the rate.

The remaining eight roadway sections all have accident rates considerably below the statewide average, ranging from 6 percent to 40 percent of the statewide rates on the two- and three-lane sections, and from 18 percent to 28 percent in the four-lane divided sections.

Overall, the accident history near the Livermore Site is good, with 8 of the 10 sections analyzed having accident rates considerably below statewide averages, while 2 of the 10 sections had rates up to 14 percent higher than the statewide averages. The rates that are above the averages are either expected to be improved or are not considered to be significant.

4.13.4 Onsite Circulation and Parking

Livermore Site

Vehicle access to the Livermore Site is provided through five security gates and one shipping and receiving gate (Figure 4.13.4–1). The principal gate is on Westgate Drive from South Vasco Road. The Westgate Badge Office is also on Westgate Drive. Westgate Drive, having the highest volume, occasionally queues traffic into the intersection at South Vasco Road, causing congestion. In 2002, a traffic study was conducted when only four gates were operating. Data from that study indicated that Westgate Drive handled 36 percent of the traffic; 8,000 vehicles per day enter and exit (LLNL 2002be). The study also showed that, with the exception of the shipping and receiving gate from East Avenue, the least used gate is the Southwest Gate. The East Avenue gate had 18 percent of the traffic; 4,000 vehicles per day enter and exit. Total weekday traffic into the five gates in the 2002 study was approximately 22,000 vehicles. In late 2002, the Mesquite Gate from South Vasco Road was opened to provide the fifth access gate.

The Livermore Site and SNL/CA, through a shared initiative, are in the process of placing the section of East Avenue between South Vasco Road and Greenville Road under enhanced security control. The roadway is scheduled to be closed to public traffic and will become a Property Protection Security Area known as the East Avenue Corridor Property Protection Area, with guard kiosks at both ends and additional traffic lane modifications (DOE 2002i). The three original East Avenue gates will continue to provide secure access to the Livermore Site. A truck inspection station for deliveries will be constructed at the northwest corner of Greenville Road and East Avenue and will only be accessible from the Greenville Road intersection. This project is part of the No Action Alternative and is currently under construction.

Once vehicles enter the site, traffic flow is dominated by an inner and outer circular loop road system shown in Figure 4.13.4–1. Two roundabouts (traffic circles) facilitate flow of traffic into and out of the loops. The onsite transportation system is also characterized by roads and streets, meandering bike and pedestrian pathways, and parking lots. Even during peak traffic periods, traffic at the Livermore Site is light. In 1999, LLNL commissioned a study of onsite traffic to obtain recommendations for improvements in traffic flow (Korve 1999). Improvements in pavement markings, signage, lane widths and crosswalk locations and elimination of angle parking were suggested and are continually being implemented.

As of mid-2002, there were approximately 8,200 parking stalls at the Livermore Site to serve approximately 9,600 employees (i.e., LLNL employees, contract employees, DOE personnel, visitors with LLNL offices, and others, not including construction workers and consultants with sporadic presence). These stalls were provided in 73 designated institutional parking lots distributed across the Livermore Site and placed with a goal of limiting walking distance from vehicle to work location to 540 feet. Some of the parking lots have a surplus of stalls, and some have a deficit, but the overall parking stall supply and demand is approximately balanced for the site. Areas with a deficit of parking stalls adapt by employees parking in other areas, parking in non-institutional parking areas (e.g., unmarked areas around buildings controlled by building managers), and parking illegally. For some areas of the Livermore Site, parking presents a limitation on growth. The *Parking Master Plan and Parking Policy* (LLNL 2002bv) discusses parking issues and recommends mitigation measures.

The safety culture and transportation infrastructure at the Livermore Site have kept the traffic accident rate very low. The latest comprehensive study of traffic data covered the years 1992 to 1998 (Korve 1999). These data suggest that the full range of accidents typical of most urban areas occur in the Livermore Site, but that the rates are lower and the so-called preventable accidents are particularly low in number. The Traffic Safety Committee works closely with the Protective Force Division to review incident and violation reports to develop a better understanding of which locations might be considered hot spots.

Site 300

Access to Site 300 is through a single gate from Corral Hollow Road. Personal vehicles are only allowed in the parking area in the GSA just beyond the gate. Only government and contractor's company vehicles are allowed on Site 300 roads. The parking stall availability is adequate to meet demand. Traffic on Site 300 roads is extremely light.

4.13.5 Hazardous and Radiological Shipments

Livermore Site

LLNL ships approximately 4,000 containers per year of hazardous and radiological waste to approximately 50 different treatment, storage, or disposal facilities across the U.S. This results in about 200 separate shipments of hazardous waste, low-level waste, and mixed hazardous waste. Additionally, LLNL sends or receives approximately 300 shipments per year of hazardous or radioactive materials involved in the mission of LLNL.

The current shipment rate is approximately 22 low-level waste shipments per year to the Nevada Test Site near Las Vegas, Nevada, and 4 mixed low-level waste shipments per year to a mixed waste treatment facility in Kingston, Tennessee. In some cases, other destinations may be selected such as the Chem-Nuclear site in Barnwell, South Carolina, the DOE *Toxic Substances Control Act* (TSCA) incinerator in Oak Ridge, Tennessee, and the Envirocare facility near Clive, Utah. Transuranic waste shipments are expected to begin in 2004 with the shipment of approximately 1,000 drums that had accumulated while waiting for disposal capacity and waste characterization and packaging capability. This one-time campaign of approximately 24 shipments to the Waste Isolation Pilot Plant in Carlsbad, New Mexico, is the beginning of a smaller annual rate that will continue into the foreseeable future.

Radioactive materials are also shipped to and from the Livermore Site as part of its mission. These include plutonium metals and oxides, uranium metals and oxides, tritium, and other radioactive materials. Current annual shipments include approximately 11 shipments of special nuclear material (primarily plutonium and uranium), approximately 5 major shipments of tritium, and approximately 60 shipments of small amounts of miscellaneous radioactive material.

Radioactive wastes and materials are routinely transferred between Livermore Site facilities without leaving the boundaries of the site. These operational transfers have the potential to expose workers to direct radiation. Such radiation exposures are accounted for under facility operations as described in Section 4.16.2. In the event of an accident, the operational transfers also have the potential to release radioactivity to the public. LLNL has carefully examined onsite transfers of radioactive materials and has established engineered and administrative controls to minimize the impact and frequency of such accidents. Two documents describe the envelope within which operations must occur to meet safety objectives. The *Onsite Hazardous Material Packaging and Transportation Safety Manual* (LLNL 1996a) prescribes operational requirements for smaller quantity transfers. The *Nuclear Material Transportation Safety Manual* (LLNL 2003e) prescribes the requirements for the larger quantity transfers. Consequences of accidents for operational transfers are reported in Section 5.5.5.

Site 300

Most of the hazardous shipments to and from Site 300 are explosives shipments. Radiological shipments, such as those containing depleted uranium, are infrequent and contain little radioactivity. Approximately 200 explosives shipments arrive per year and 100 are sent per year. The outgoing shipments include explosive waste that cannot be treated at the Explosive Waste Treatment Facility at Site 300. These explosive wastes are currently shipped to a licensed facility in Louisiana but could be shipped to other locations. The shipment of explosive materials can be hazardous. LLNL has analyzed the hazards of explosives transport and prepared procedures for safe operations (LLNL 1996a). All onsite and Site 300 shipment operations are conducted within the bounds of the safety envelop established by that analysis. All offsite shipments are conducted in accordance with U.S. Department of Transportation regulations. There have been no explosions or fires resulting from accidents with explosive shipments.

4.13.6 Alternate Modes of Transportation

Livermore Site

As of June 2002, 87 percent of Livermore Site personnel commuted to work alone in personal vehicles. The remaining commuters traveled by carpool (3 percent), vanpool (3 percent), bicycle (1 percent), and public transit (4 percent) (LLNL 2001d). Because the Bay Area suffers from heavy traffic congestion, LLNL has established programs to help commuters find alternative means to get to work.

LLNL’s Transportation Systems Management Program maintains a database that commuters can use to advertise for new riders or to find an appropriate carpool. There are approximately 300 carpools in use. LLNL provides preferential parking for those willing to use carpools. Similarly, there are approximately 30 vanpools. Vans are either leased or privately owned. A LLNL incentive program provides gasoline at reduced prices for vanpools.

Mass transit opportunities include the ACE, BART, Livermore Amador Valley Transit Authority, and commuter buses. ACE is a rail service between Stockton and San Jose, passing through Livermore, Pleasanton, and other points along the route. The LLNL taxi service provides free shuttle service between the ACE Train South Vasco Station and the Livermore Site. BART provides rapid transit rail service from San Francisco, Oakland, and other points in the Bay Area with a station in Pleasanton/Dublin. WHEELS is a service of the Livermore Amador Valley Transit Authority and provides public transportation for the Tri-Valley communities of Dublin, Livermore, and Pleasanton, with stops at the Livermore Site. Commuter buses from points in San

Joaquin and Contra Costa counties provide service directly to the Livermore Site. A shuttle van also runs between the Livermore Site and the University of California campus at Davis.

Site 300

The LLNL Transportation Systems Management Program provides services for setting up carpools and vanpools for employees of Site 300. There is neither public transportation nor LLNL shuttle service to Site 300.

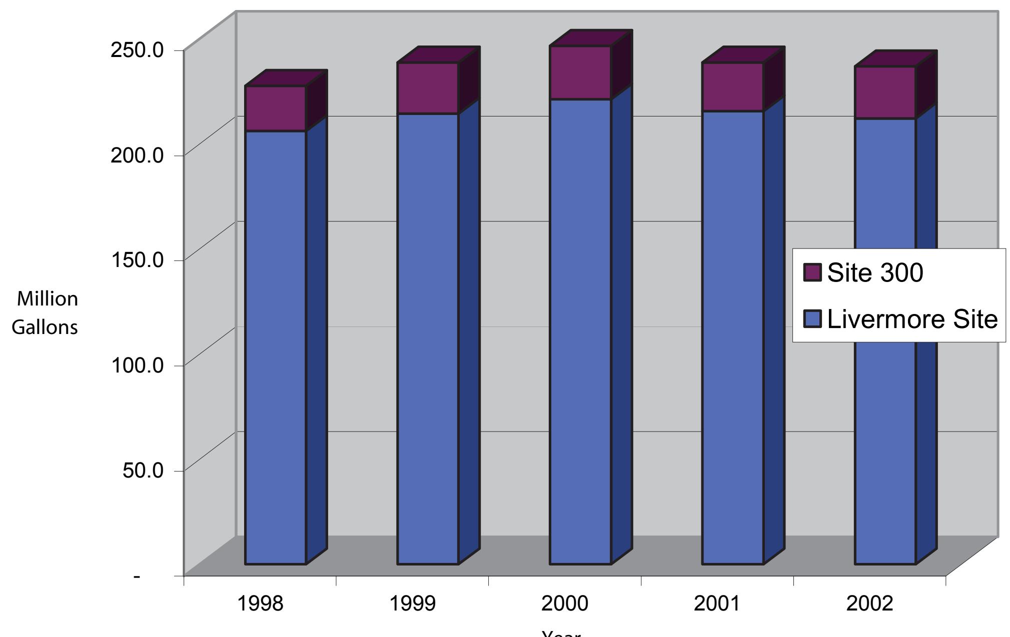
4.13.7 Aircraft Operations

The Livermore Municipal Airport is located just south of I-580 at Airway Boulevard. The Airport occupies 400 acres and has been in operation at its existing location since 1965. The airport has approximately 570 based aircraft and 250,000 annual aircraft operations. LLNL leases aircraft for research and conducts research while on aircraft managed by others. The manned and unmanned aircraft fly in the Livermore Valley and around Site 300, as well as other sites outside of the area.

4.14 UTILITIES AND ENERGY

4.14.1 Water Consumption

Water consumption for the Livermore Site and Site 300 remained relatively constant from 1998 to 2002 (Figure 4.14.1–1). Water consumption at the Livermore Site averaged 214 million gallons over the 5-year period with a standard deviation of 5.5 million gallons. This standard deviation represents a 2.6 percent variation from the average. At Site 300, water consumption averaged 23.8 million gallons over the same 5-year period with a standard deviation of 1.5 million gallons. This standard deviation represents a 6.5 percent variation from the average. The annual average total consumption for both sites was 237.8 million gallons with a standard deviation of 6.8 million gallons. This standard deviation represents a 2.9 percent variation from the average.



Source: Original.

FIGURE 4.14.1–1.—Annual Water Consumption for the Livermore Site and Site 300, 1998 through 2002

Livermore Site

Water for the Livermore Site is provided by three sources (LLNL 2003cj):

- The primary supply is from the city of San Francisco's Hetch Hetchy water system.
- A backup supply is available from Zone 7 of the Alameda County Flood Control and Water Conservation District.
- Cross-connections exist with the city of Livermore water line for fire protection through a mutual aid agreement (LLNL 2003cj).

Water consumption rates at the Livermore Site have decreased from an average of 261.8 million gallons per year in 1986, to 212 million gallons per year (581,000 gallons per day) in 2002 (LLNL 2003al, LLNL 2003ce). Currently, peak water usage is approximately 1.2 million gallons per day and is projected to increase to approximately 1.38 million gallons per day as the NIF (110,000 gallons per day) and the Terascale Simulation Facility (60,000 gallons per day) become operational. The capacity of the domestic water system is 2.88 million gallons per day (LLNL 2003cj).

Site 300

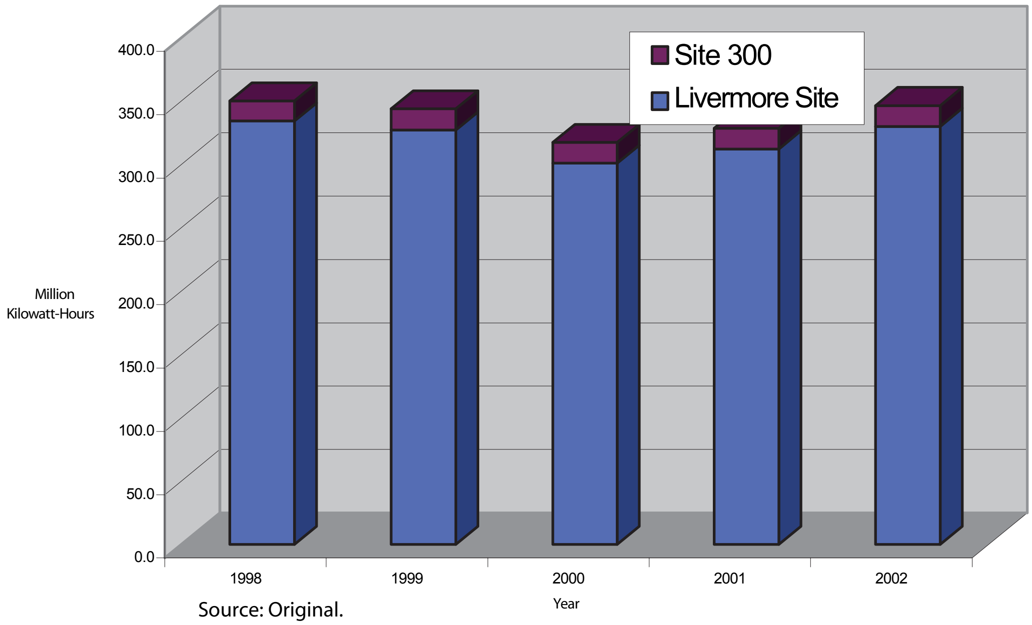
Site 300 is supplied with water from a system of wells. The existing capacity of usable wells is approximately 930,000 gallons per day. A project to connect Site 300 with water pumped from the city of San Francisco's Hetch Hetchy water supply system should be completed by early 2004. The capacity of this new system is estimated to be 648,000 gallons per day, with the capability of expanding to 1.2 million gallons per day (LLNL 2000a).

Site 300 consumed an average of 23.8 million gallons per year (67,900 gallons per day) from 1998 to 2002 (LLNL 2003aq, LLNL 2003cj). Water consumption rates at Site 300 have remained relatively constant during the past 5 years, but reflect a 22-percent decrease from the 31.8 million gallons per year reported in the 1992 SWEIS (LLNL 1992a).

4.14.2 Electricity Consumption

Electricity consumption for the Livermore Site and Site 300 has remained relatively flat from 1998 to 2000 (Figure 4.14.2–1). Electricity use at the Livermore Site decreased in 1999 and 2000, and increased in 2001 and 2002. Electricity consumption at Site 300 remained relatively constant during the same period.

Electricity consumption at the Livermore Site averaged 321 million kilowatt-hours per year over the 5-year period (1998 to 2002) with a standard deviation of 13.9 million kilowatt-hours. This standard deviation represents a 4.3 percent variation from the average. At Site 300, electricity consumption averaged 16.3 million kilowatt-hours per year over the same 5-year period with a standard deviation of 0.4 million kilowatt-hours. This standard deviation represents a 2.2-percent variation from the average. The total consumption for both sites was 337.3 million kilowatt-hours per year with a standard deviation of 13.8 million kilowatt-hours. This standard deviation represents a 4.1-percent variation from the average.



Source: Original.

FIGURE 4.14.2–1.—*Annual Electricity Consumption for the Livermore Site and Site 300, 1998 through 2002*

Livermore Site

Pacific Gas and Electric (PG&E) and the Western Area Power Administration supply electrical power to the Livermore Site. The electrical energy used at the Livermore Site is devoted almost entirely to the operation of office buildings and research laboratory facilities. Under DOE guideline definitions of "building" and "metered process," Livermore Site space is classified as approximately 50 percent "building" and 50 percent "metered process" load.

Electrical power usage at the Livermore Site declined from about 360 million kilowatt-hours per year in 1990 to about 330 million kilowatt-hours per year in 2002 (LLNL 2003ce). The peak electrical load at the Livermore Site was 57 megawatts in 2002 and is projected to increase to 82 megawatts as the NIF (approximately 12 megawatts), Terascale Simulation Facility (approximately 11 megawatts), and other site projects become operational (LLNL 2003cj).

Site 300

PG&E supplies electrical power to Site 300. From 1998 to 2002, Site 300 consumed an average of 16.3 million kilowatt-hours per year. Electricity consumption rates at Site 300 have remained stable over the past 5 years, but reflect a 24.9 percent decrease from the 1992 average of 21.75 million kilowatt-hours per year.

The electrical load at Site 300 averages 2.7 megawatts and is projected to increase to 2.8 megawatts as site improvements are completed (LLNL 2000a). The peak electrical load in 2002 was 3.4 megawatts (LLNL 2003cj).

4.14.3 Fuel Consumption

Livermore Site

Natural Gas

PG&E supplies natural gas to the Livermore Site by way of the meter station at the south end of Southgate drive. Natural gas is used mostly for comfort heating in the building category. In the metered process category, natural gas is used mostly for programmatic experiments and comfort heating. Continuing efforts to decrease energy use include modification to HVAC controls, the design of more efficient buildings, boiler tune-ups, and other site energy conservation efforts.

In 2002, annual natural gas consumption at the Livermore Site totaled 4.7 million therms (12,900 therms per day). Peak consumption in 2002 was 18,700 therms per day and is expected to increase to approximately 23,300 therms per day as the NIF and Terascale Simulation Facility become operational. Natural gas consumption rates at the Livermore Site have remained relatively constant during the past 5 years, but reflect a 27.3 percent increase from the 3.69 million therms per year reported in the 1992 LLNL EIS/EIR (LLNL 1992a). The current capacity of the natural gas system is 24,500 therms per day (LLNL 2003cj). One therm is equivalent to 100,000 British thermal units.

Diesel Fuel

Diesel fuel is used in vehicles and heavy equipment and for backup electric power generation in the building category. Diesel fuel use averages 72,200 gallons per year (LLNL 2003cf, LLNL 2003cg), a 16.7-percent decrease from the 1992 average of 86,600 gallons per year (LLNL 1992a).

Unleaded Gasoline

At the Livermore Site, unleaded gasoline use averages 451,800 gallons per year (LLNL 2003cf), a 9 percent decrease from the 1992 average of 496,200 gallons per year (LLNL 1992a).

Site 300

At Site 300, fuel oil is used mostly for backup electric power generation in the building category. In the metered process category, fuel oil is used for comfort heating and in some experiments.

Fuel oil consumption at Site 300 averages 16,600 gallons per year (LLNL 2003aq), a 79-percent decrease from the 1992 average of 78,100 gallons per year (LLNL 1992a). This substantial decrease in fuel oil consumption is primarily due to completion of HVAC retrofit and modernization projects.

4.14.4 Sewer Discharges

Livermore Site

The Livermore Water Reclamation Plant (LWRP) handles sewage from the Livermore Site. Sewage flows through two main laterals on the east and west sides of the site, combines in a flow-measuring flume near Building 196 (located at the northwest corner of the Livermore Site), then leaves the site and enters the city of Livermore's sewer system. The western lateral includes wastewater from SNL/CA. From 1998 to 2002, Livermore Site and SNL/CA daily flows averaged a total of 238,500 gallons per day (LLNL 2003l), with a peak of 626,330 gallons per day (LLNL 2003cj). The Livermore Site portion of the 5-year daily average is approximately 220,400 gallons per day (LLNL 2003al, LLNL 2003cj). LLNL maintains a sewer diversion facility to protect city of Livermore treatment facilities against accidental contamination. Up to 205,000 gallons of potentially contaminated sewage can be held pending analysis to determine the appropriate handling method (LLNL 2003cj).

Sewer discharges at the Livermore Site have remained stable over the past 5 years with small variations in flow (Figure 4.14.4–1). In 2002, sewer discharges attributable to the Livermore Site averaged 216,400 gallons per day (LLNL 2003l). Most discharges to the sanitary sewer system at the Livermore Site are considered batch discharges, since they occur on a sporadic basis. Because these discharges occur randomly and as necessary, there is considerable variation both in the number of discharges per month and in the time of day of the discharges. One exception is the cleaning of cooling towers. Generally, each tower is emptied once a year. This usually occurs during the winter months, when demand on the towers is lower, and on weekends, when more capacity is available in the Livermore Site sewer system.

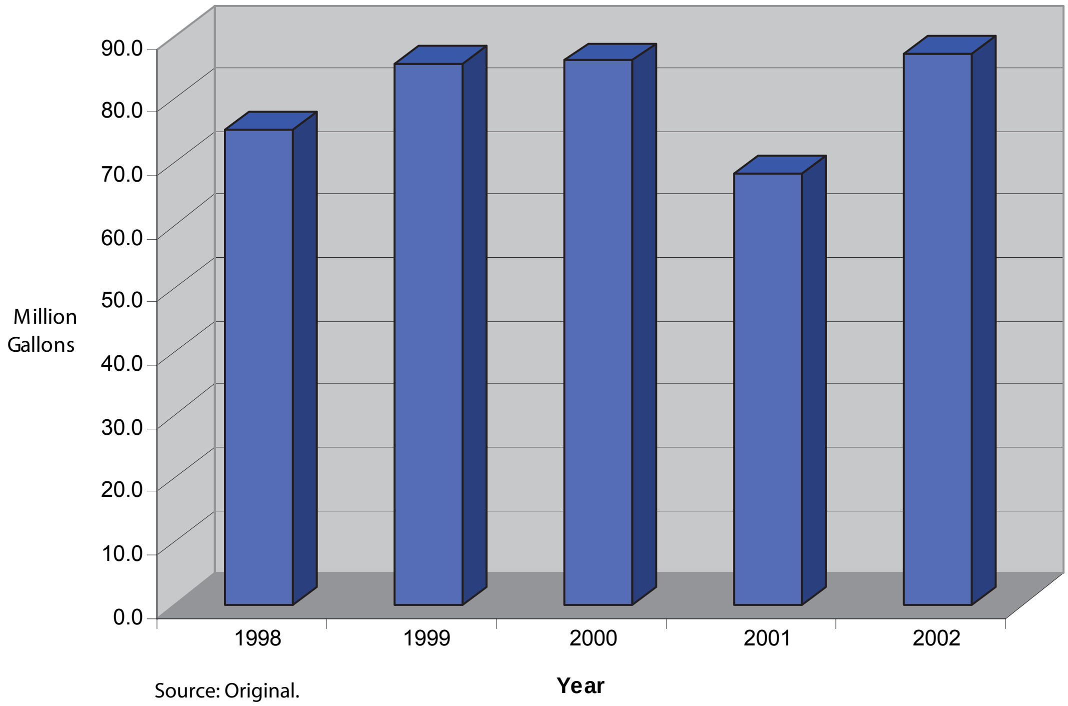


FIGURE 4.14.4–1.—*Annual Sewer Discharges for the Livermore Site, 1998 through 2002*

There are four principal sources of large-volume batch discharges: air washes, cooling towers, boilers, and wastewater treatment/retention tanks. The amount of releases to the sanitary system varies substantially for each. These four principal sources of large-volume batch discharges are briefly discussed below (LLNL 2000z).

Air Washes

There are 26 building air washes, ranging in capacity from about 4 to 1,500 gallons. Each air wash is cleaned and the water is released to the sanitary sewer once a year at a rate of approximately 15 gallons per minute. Only one air wash is cleaned at a time (LLNL 2000z).

Cooling Towers

There are four active sets of cooling towers at the Livermore Site: three large sets located at U291, U325, and OS683; and one small set at Building 133. The large cooling tower complexes have capacities ranging from 20,000 to 252,000 gallons. The cooling towers are emptied and cleaned on a schedule that ranges from annually to every three years, depending on the tower. Only one tower is cleaned on a given day, and the flow is controlled to release at a rate that will not overflow the sewer-monitoring weir. Unlike other discharges, the cooling towers are generally emptied on weekends and on colder days. The maximum discharge occurs when the largest tower (U235) is cleaned; that discharge includes five cells, totaling approximately 150,000 gallons (LLNL 2000z).

In 1997, a sand filtration system consisting of three filters, each with a separate tank, was installed at the U291 cooling tower. The OS683 cooling tower also has a sand filtration system.

The sand filters are backwashed daily using cooling tower blowdown water. The sand filter backwash is discharged to the sanitary sewer (LLNL 2000z).

Boilers

There are 121 boilers on the Livermore Site: 23 are steam boilers and the remaining 98 are hot water boilers. Only the steam boilers have regular blowdown releases, and eight of the steam boilers have a continuous, rather than batch, blowdown. The remaining 15 steam boilers discharge approximately 5 to 10 gallons, 3 times per week, at a rate of 5 to 6 gallons per minute. Other than the eight continuous discharges, blowdown of the boilers is a manual procedure, and only one boiler is released at a time.

The steam boilers, which hold an average of approximately 1,500 gallons each, are emptied once a year for cleaning. The hot water boilers hold an average of 400 gallons each and are drained every two years (LLNL 2000z).

Wastewater Treatment/Retention Tanks

The Livermore Site has 33 wastewater retention systems, including the liquid waste treatment area and the sewer diversion facility (LLNL 2003l). Each of these systems contains sumps or tanks that can make releases to the sewer if concentrations of the constituents in the system meet discharge limitations; however, the contents of some of the retention systems are never released to the sewer. Most of the retained wastewater is generated at the Livermore Site, but some wastewater is received from Site 300 for treatment or discharge to the sanitary sewer or for disposal as a hazardous waste (LLNL 2000z).

When wastewater is discharged to the sewer system, it combines with other sewage from the Livermore Site and SNL/CA. The combined flow leaves the Livermore Site at Building 196, the Sewage Monitoring Station. The Livermore Site Sewage Monitoring Station is equipped with a continuous monitoring system designed to detect radiation, excessive pH, and metals. To protect the LWRP and to minimize any cleanup that might become necessary, the Livermore Site has an onsite sewage diversion and retention system. This system is capable of containing approximately 205,000 gallons of potentially contaminated sewage until analyses can be completed and appropriate handling methods are determined. This system would contain approximately 6 hours of total discharge from the SNL/CA and Livermore Site facilities. The system ensures that, if the alarm is triggered by the flow, all but the first few minutes of flow is retained at the Livermore Site for evaluation of appropriate treatment for disposal (LLNL 2003l). The city of Livermore has a holding basin into which releases can be diverted for further analysis and disposition. It takes approximately 3 hours for sewage to reach the LWRP from the Livermore Site sewage monitoring station; therefore, the city has adequate time to divert the flow if necessary (LLNL 2000z).

In addition to continuous monitoring of the effluent, sewer samples are collected from both the sewage monitoring station (Building 196) and the LWRP. Samples are analyzed daily for radioactivity and are composited monthly to determine the concentrations of specific isotopes (cesium-137 and plutonium-239) and various metals (LLNL 2000z). Samples are collected quarterly at the point of discharge of specified metal finishing and electrical and electronic component categorical processes to ensure compliance with wastewater discharge permit limits for those processes. LLNL experienced one permit exceedance from an elevated lead concentration in 2002. The concentrations of all other anions, metals, and organic compounds were well below their respective discharge limits (LLNL 2003l).

The LLNL 2002 Annual Environmental Monitoring Report reports that LLNL is in compliance with all regulations and guidelines governing releases of radioactivity to the sanitary sewer (LLNL 2003l). Since 1992, the concentrations of radionuclides in Livermore Site sewage have steadily declined. The 2002 annual average activity levels of radionuclides in wastewater were 2.3×10^{-5} picocuries per milliliter for cesium-137, 3.5×10^{-6} picocuries per milliliter for plutonium-239, and 0.068 picocuries per milliliter for tritium. A total of 0.02 curies of tritium were released in wastewater during 2002 by LLNL and SNL/CA, representing 0.4 percent of the 10 CFR Part 20 limit. The discharges of plutonium-239 and cesium-137 represented even smaller portions of their respective limits (LLNL 2003l).

Site 300

Site 300 sanitary sewage generated outside the GSA is disposed of through septic tanks and leachfields or cesspools at individual building locations. Sanitary sewage generated at the GSA is piped into an asphalt membrane-lined oxidation pond east of the GSA at an average rate of 2,100 gallons per day (LLNL 2000a).

Wastewater discharges from Site 300 are handled in a variety of ways. In the GSA, wastewater is treated and piped into an asphalt membrane-lined oxidation pond at an average rate of 2,100 gallons per day, with overflow to an evaporation-percolation pond. GSA sewage is domestic in nature. Sanitary sewage generated outside the GSA is disposed of through septic tanks and leach fields or cesspools at individual building locations (LLNL 2000a).

In the process and chemistry areas, industrial wastewater goes through a clarifier and weir system and is discharged to two Class II surface impoundments located south of Building 817. Wastewater from the chemistry buildings and photo lab rinsewaters are trucked to the clarifier/weir system for treatment prior to discharge into the surface impoundment. Explosive process waste from the machining area and pressing facility is plumbed directly to the treatment system (LLNL 2000a).

Cooling tower wastewater from various Site 300 operations is currently discharged in accordance with prescribed permit conditions to septic systems, the sewage evaporation and percolation ponds, engineered percolation systems, or in a manner that otherwise percolates into the ground. Wastewater from mechanical equipment, other than cooling towers, is discharged to septic systems, the sewage evaporation and percolation ponds, and engineered percolation systems. Wastewater generated at the contained firing facility is evaporated. Other industrial wastewater generated at Site 300 is stored in retention tanks, drummed, and hauled to the Livermore Site for reprocessing and/or disposal (LLNL 2000a).

4.14.5 Resource Conservation and Waste Minimization

Livermore Site and Site 300

Through implementation of DOE O 430.2A, DOE requires that LLNL attain the following energy usage goals:

- Reduce energy consumption per gross square foot for buildings through life-cycle cost-effective measures by 40 percent by 2005 and 45 percent by 2010, using a 1985 baseline.

- Reduce energy consumption per gross square foot (or other unit as applicable) for laboratory and industrial facilities through life-cycle cost-effective measures by 20 percent by 2005 and 30 percent by 2010, using a 1990 baseline.

- Increase the purchase of electricity from nonhydroelectric renewable energy sources by including provisions for such purchases as a component in all future DOE competitive solicitations for electricity. DOE will purchase 3 percent of its total electricity needs from nonhydroelectric renewable energy sources by 2005 and 7.5 percent of its total from nonhydroelectric renewable energy sources by 2010. Nonhydroelectric renewable energy is energy generated from solar, geothermal, biomass, or wind technologies.

- Increase the purchase of electricity from less greenhouse gas-intensive sources, including, but not limited to, new advanced technology fossil energy systems and other highly efficient generating technologies.

- Retrofit or replace all chillers greater than 150 tons of cooling capacity and manufactured before 1984 that use Class I refrigerant by 2005.

- Reduce greenhouse gas emissions attributed to facility energy use through life-cycle cost-effective measures by 25 percent by 2005 and 30 percent by 2010, using 1990 as a baseline. Greenhouse gas emissions are carbon dioxide emissions calculated from reported energy consumption.

To achieve these goals, the Energy Management Program performs studies and conducts surveys to identify opportunities for retrofit projects to reduce energy use at LLNL. In 2002, LLNL achieved a 23 percent reduction in energy use from 1990 levels.

NNSA has mandated that LLNL will attain the following waste reduction goals:

- Reduce hazardous waste from routine operations by 90 percent by 2005, using 1993 as a baseline.

- Reduce the amount of waste in all radioactive waste streams by 80 percent by 2005, using 1993 as a baseline.

- Reduce sanitary waste from routine operations by 75 percent by 2005 and 80 percent by 2010, using a 1993 baseline.

- Recycle 45 percent of sanitary wastes from all operations by 2005 and 50 percent by 2010.

- Reduce waste resulting from cleanup, stabilization, and decommissioning activities by 10 percent on an annual basis.

In 2002, LLNL generated approximately 5,800 metric tons of routine sanitary waste, a 1 percent reduction since 1993 (LLNL 2003l). However, LLNL diverted 4,000 metric tons, or 69 percent, of its sanitary waste for recycling or reuse. Additional details regarding waste reduction are provided in Appendix O, Pollution Prevention.

Beginning in 1988, LLNL began curtailing water use by implementing several water conservation measures. The following water use limitations and/or restrictions exist at LLNL:

- Reduce landscape watering to 35 percent below 1989 levels.

- Reduce blowdown in cooling towers to minimal operable levels.

- Use reclaimed groundwater in place of potable water in cooling towers to the greatest extent possible.

- Monitor all water use to discourage waste or unnecessary use.

4.15 MATERIALS AND WASTE MANAGEMENT

This section provides an overview of management responsibilities regarding receipt, transfer, and shipment of radioactive, controlled, and hazardous materials and wastes as well as mixed and medical wastes at LLNL. Additional supporting information and analyses, including descriptions of programs and buildings associated with use of these materials, are provided in Appendices A and B. The use of these materials historically has resulted in both their planned and inadvertent releases to the environment. The consequences of using radioactive, controlled, and hazardous materials are discussed in the sections associated with the affected media. For example, releases to the air associated with the use of radioactive materials are discussed in Section 4.10, and releases affecting vegetation are discussed in Section 4.9. The workplace use of these materials and associated occupational exposures are discussed in Section 4.16. Pollution prevention and waste minimization are discussed in Appendix O.

4.15.1 Materials

4.15.1.1 *Regulatory Setting*

LLNL's materials management operations are conducted pursuant to DOE orders and to various applicable Federal, state, and local laws and regulations. Regulatory oversight is vested among various Federal, state, and local agencies. Major laws, regulations, and orders are summarized in Table 4.15.1.1–1.

4.15.1.2 *Radioactive, Controlled, and Hazardous Materials Management*

Radionuclide Inventories

LLNL uses radioactive materials in a wide variety of operations including scientific and weapons R&D, diagnostic research, research on the properties of materials, and isotope separation. A list of Livermore Site selected facility inventories, approximate quantities, and status by radionuclide is provided in Table 4.15.1.2–1. Radioactive material quantity limits for Site 300 are included in Table 4.15.1.2–2. Based on facility design and operation, LLNL establishes administrative limits for fissile, special use, radioactive, and sealed materials. An administrative limit is the total amount of certain materials allowed in a specific building at LLNL. These limits are used in determining potential risks associated with accidents. For a discussion on accidents and materials at risk, see Section 5.5, Bounding Accident Scenarios. Actual inventories may be classified.

LLNL Material Categories

Category 1 materials are hazardous or other materials that are also "controlled materials" because of their security classification, high value, or special hazards. Examples are:

- Accountable nuclear materials
- Carcinogens (if accountable or classified)
- Classified parts and materials (other than documents)
- Explosives
- Material contaminated with accountable amounts of controlled material
- Mock explosives
- Precious metals, gems, and other valuable materials
- Radioactive materials
- Special reactor materials

Category 2 materials are unclassified hazardous wastes (e.g., asbestos, spent acids) of negligible economic value, such as radioactive and mixed waste.

Category 3 materials are all hazardous materials other than those that fall into Category 1 or 2. Category 3 includes most industrial and laboratory chemicals that are not wastes (LLNL 1996a).

TABLE 4.15.1.2–2.—*Approximate Radioactive Quantities Managed at Site 300*

Material	Use	Allowed Quantities[a, b]
Depleted uranium	Assembly components	4.2 Ci
		10,640 kg
Thorium-232	Assembly components	0.1 Ci
		910 kg
Tritium	Assembly components	193 Ci
		20 mg

Source: LLNL 2002l.
[a] Units presented are those found in the reference document.
[b] Quantities are snapshots in time.
Ci = curies; kg = kilograms; mg = milligrams.

Chemical Inventories

Because of the wide variety of research activities performed at LLNL, the amounts and concentrations of chemicals maintained vary at any given time and from facility to facility. Most research operations use small quantities of a wide variety of chemicals; however, in some operations, chemicals are used in large quantities. In general, the following chemical types are used and stored at LLNL:

- Corrosives (acids and bases)

- Toxics (poisonous chemicals)
- Flammables and combustibles (solids, liquids, and gases)
- Reactives (materials that are inherently readily capable of detonation or becoming flammable at normal temperatures and pressures)
- Asphyxiants (physical asphyxiants are materials capable of physically displacing the volume of air in a given space; chemical asphyxiants are materials that inhibit oxygen transfer from blood tissues or within cells when breathed)
- Carcinogens (materials capable of inducing cancer)

The primary management strategy for the control and management of hazardous chemicals at LLNL is to prevent overexposures to hazardous substances in accordance with the requirements of 29 CFR Part 1910[z]. Procedures for chemical management at LLNL include personnel training, inventory control and monitoring, safety assessments, and handling. Additionally, standard operating procedures, operating procedures, and operating instructions are prepared for specific activities to establish safe procedures, barriers, controls, and safe work practices with regard to hazardous operations, including chemical use and storage.

As part of the chemical management strategy, LLNL maintains a centralized chemical inventory database, the ChemTrack system, for tracking hazardous and chemicals in primary (those containers shipped by the manufacturer). The ChemTrack system requires bar coding of chemical containers as they enter LLNL to allow container tracking and access to online chemical inventory data. The bar-coded chemical containers are tracked to provide location and usage information from arrival at LLNL through disposal of the container by the waste management program. LLNL links the bar-coded chemical containers to a location and a chemical custodian (a person[s] or organization); the material safety data sheets, if available; related chemical property and hazardous data; and regulatory information. The ChemTrack system serves as the chemical inventory resource used for meeting Federal *Emergency Planning and Community Right-to-Know Act* (EPCRA) reporting and California community right-to-know requirements.

In 2001, more than 166,000 chemical containers, ranging from 55-gallon drums to small-quantity vials, were in use or stored at LLNL (LLNL 2002cc). Table 4.15.1.2–3 presents a representative list of FY2001 hazardous chemicals at the Livermore Site. A detailed list of chemicals at the NIF is provided in Appendix M. A detailed list of chemicals at LLNL is provided in Appendix B.

TABLE 4.15.1.2–3.—*Partial List[a] of Hazardous Chemicals in Use at the Livermore Site Under Existing Conditions*

Chemical	Chemical Abstract Number	Average Maximum/Average Quantity[b]
Paints/Solvents		
Paint (variety)	NA	700,000/320,296 lb
Thinner, lacquer	NA	3,000/500 gal
Methylene chloride	75-09-2	2,000/55 gal
Methyl alcohol	67-56-1	1,800/500 gal
Acetone	67-64-1	1,200/740 gal
Metals		
Lead bricks or ingots	NA	1,000,000 lb
Tantalum	7440-25-7	75,000/20,000 lb
Cobalt	7440-48-4	16,500/14,000 lb
Aluminum	7429-90-5	5,000/800 lb
Chrome or chromium	7440-47-3	4,700/1,500 lb
Beryllium	7440-41-7	1,600/1,000 lb
Acids/Bases/Oxidizers		
Oxygen, compressed	7782-44-7	870,000/75,000 ft^3
Hydrogen peroxide<52%	7722-84-1	42,000/18,000 gal
Ammonium hydroxide	1336-21-6	30,000/1,600 lb
Sodium hydroxide	1310-73-2	25,500/14,000 lb
Potassium hydroxide	1310-58-3	15,000/400 lb
Sulfuric acid	7664-93-9	11,000/4,500 lb
Nitric acid	7697-37-2	7,810/5,000 lb
Phosphoric acid	7664-38-2	3,600/1,000 lb
Cyanuric acid	108-80-5	2,500/500 lb
Hydrofluoric acid	7664-39-3	1,500/850 lb
Industrial Gases		
Argon, compressed	7440-37-1	25,000,000/160,000 ft^3
Helium	7440-59-7	5,000,000/300,000 ft^3
Hydrogen, compressed	1333-74-0	1,500,000/50,000 ft^3
Nitrogen, compressed (Liquified, gaseous)	7727-37-9	500,000/130,000 ft^3
Carbon dioxide	124-38-9	176,000/124,000 ft^3
Refrigerants		
Freon 113 (1,1,2-Trichloro-1,2,2-trifluoroethane)	76-13-1	170,000/16,000 lb
Refrigerant, 123 SUVA, (2,2-Dichloro-1,1,1-trifluoroethane)	306-83-2	35,000/1,500 lb
Freon 22 (Chlorodifluoromethane)	75-45-6	9,000/5,000 lb
Freon 11 (Trichlorofluoromethane)	75-69-4	10,000/5,000 lb
Freon 12 (Dichlorodifluoromethane)	75-71-8	6,300/4,000 lb
Freon 14 (Tetrafluoromethane)	75-73-0	2,000/500 ft^3

Source: NNSA 2002c.
[a] For a comprehensive list covering other chemicals like chlorine, please refer to Appendix B.
[b] Represents average maximum and average quantity based on one or more buildings as reported in 2001 and 2002. The information represents a snapshot and is intended to give the reader an understanding of the variety and relative quantities.
ft^3 = cubic feet ; gal = gallons; lb = pounds; NA = not available.

A representative listing of chemical inventories in FY2001 for Site 300 is presented in Table 4.15.1.2–4. Site 300 operations generally require smaller chemical inventories than the Livermore Site due in part to fewer operations and programs. More details on chemical inventories at Site 300 are provided in Appendix B.

TABLE 4.15.1.2–4.—*Types of Hazardous Chemicals (Partial List[a]) in Use at Site 300*

Chemical	Chemical Abstract Number	Average Maximum/Average Quantity[b]
Paints/Solvents		
Paint (variety)	NA	7,200/1,200 lb
Thinner, lacquer	NA	310/95 gal
Methyl alcohol	67-56-1	90/5 gal
Acetone	67-64-1	400/30 gal
Metals		
Lead bricks or ingots	NA	25,000/25,000 lb
Acids/bases/oxidizers		
Oxygen, compressed	7782-44-7	16,000/5,000 ft^3
Sulfuric acid	7664-93-9	845/60 lb
Cyanuric acid	108-80-5	500/50 lb
Industrial Gases		
Argon, compressed	7440-37-1	30,000/30,000 ft^3
Helium	7440-59-7	25,000/25,000 ft^3
Hydrogen, compressed	1333-74-0	700/700 ft^3
Nitrogen, compressed (liquified, gaseous)	7727-37-9	312,000/280,000 ft^3
Carbon dioxide	124-38-9	44,000/5,000 ft^3
Refrigerants		
Freon 113 (1,1,2-Trichloro-1,2,2-trifluoroethane)	76-13-1	150/10 gal
Freon 22 (Chlorodifluoromethane)	75-45-6	1,400/870 lb
Freon 12 (Dichlorodifluoromethane)	75-71-8	660/220 lb
Freon 13 (Chlorotrifluoromethane)	75-72-9	478/478 ft^3
Freon 14 (Tetrafluoromethane)	75-73-0	2,000/500 ft^3
Explosives		
More than one type and class	NA	100,000/10,000 lb

Source: NNSA 2002c.
[a] For a comprehensive list covering other chemicals like chlorine, please refer to Appendix B.
[b] Represents average maximum and average quantity based on one or more buildings as reported in 2001 and 2002. The inventories represent a snapshot and are intended to give the reader an understanding of the variety and relative quantities of materials.
ft^3 = cubic feet ; gal = gallons; lb = pounds; NA = not available.

Explosive Materials

LLNL uses explosives in various R&D and test applications. Explosive quantities used per activity range from milligrams to several kilograms; however, for special test applications several hundred kilograms may be handled. Overall, the quantities of explosive material maintained onsite are restricted by the approved explosive capacity of various storage areas.

Site 300 is the primary laboratory location for explosives storage. This site is designated as a limited area accessible to approved personnel only. In 2001, 59 locations handled explosives. The explosives storage includes nearly 40 earth-covered explosive storage magazines, approximately 10 magazettes, and 1 packaging/receiving building. Other facilities include those for machining, assembling, pressing, testing, and firing explosives (see Appendix A). At the Livermore Site, the HEAF conducts explosive R&D (see Appendix A).

An explosives safety program is used to manage explosives at LLNL. The LLNL Explosives Safety Committee provides continual review, interpretation, and necessary revision to the explosives safety program. As part of its explosive material management strategy, LLNL uses facility-based explosives inventory systems to track and manage explosive inventories. The inventory systems maintain information on material composition, characteristics, and shipping requirements; life cycle cost information; plan of use; security and hazard classifications; and compatibility codes. When an explosive material is transferred (delivery or receipt), the system requires a safety check to ensure that the intended storage location can accept the type and quantity of material received. The facility-based inventory systems flag any storage capacity overages and incompatible explosive items.

Onsite Receipt and Distribution

LLNL classifies certain materials as controlled materials for environment, safety, and health (ES&H) protection, security, strategic importance, monetary value, or programmatic urgency reasons. Some of these materials are also classified as hazardous. Examples of controlled materials include explosives, radioactive materials, special nuclear materials, classified substances and parts, and precious metals.

All Category 3 hazardous materials and some Category 1 materials (see text box for category descriptions) shipped by commercial vendors or other DOE sites are received by the Receiving Section of the Materials Distribution Division (MDD), Procurement and Materiel Department. An exception is made when MDD and the ES&H Team Leader have reviewed and authorized a specific, direct delivery area. Direct delivery areas must meet established ES&H requirements that include both administrative and physical controls. Figure 4.15.1.2–1 illustrates conceptually how materials move at LLNL. Special arrangements are in place for industrial gases and 55-gallon chemical and solvent drums that are received at the Industrial Gas Yard by the Industrial Gases Section of MDD, Building 518.

Hazardous materials enter Site 300 through the Receiving Group of MDD; explosives and other controlled materials are delivered to and received by the Site 300 Controlled Materials Group of the Materials Management Section.

The Materials Management Section of the Mechanical Engineering Department receives Category 1 materials from vendors, the MDD, and other DOE sites. These include radioactive materials, accountable nuclear material, nuclear explosive-like assemblies, classified parts, and controlled or classified hazardous materials (e.g., some alkali metals and carcinogens). Fissile materials are sent only to the main Livermore Site through Materials Management, whereas explosives are sent only to Site 300 through Materials Management. The Materials Management Section, along with the requester, arranges for storage and transportation of these materials and delivers them to qualified end users.

The Industrial Gases Section of MDD ensures that the material received is properly packaged and secured. Bar codes are placed on each primary chemical container, which is then entered into the ChemTrack system at the time of receipt.

The Radioactive and Hazardous Waste Management (RHWM) Division of the EPD receives reusable hazardous materials (Chemical Exchange Warehouse, Figure 4.15.1.2–1) and hazardous waste, including hazardous waste generated from the use of Category 1 and 3 materials (some limitations apply). At the Chemical Exchange Warehouse, RHWM staff arranges for the reuse or temporary storage and/or transportation of such materials to RHWM treatment and storage facilities in accordance with LLNL guidelines and applicable RHWM operational procedures.

The Site 300 Controlled Materials Group (CMGRAMS) of the Materials Management Section (of the Mechanical Engineering Department) is responsible for packaging, marking, and labeling explosives shipments leaving Site 300 and the Livermore Site in a manner that complies with U.S. Department of Transportation (DOT), DOE, and LLNL standards. To ensure that the standards are observed, all explosives shipments to or from offsite locations are delivered in accordance with Document 21.2, “Onsite Hazardous Materials Packaging and Transportation Safety Manual” (LLNL 1996a) in the ES&H Manual. Controls for shipping and transporting explosives offsite are described in Document 21.4, “Shipping Explosives Offsite” (LLNL 2001h) in the ES&H Manual. All incoming explosive material is labeled and the transport is placarded DOT Division 1.1, 1.2, 1.3, 1.5, or 1.6 (see text box).

Explosive Materials

An explosive is any substance or article, including a device, which is designed to function by explosion or which, by chemical reaction within itself, is able to function in a similar manner even if not designed to function by explosion (unless the article is otherwise classified under a provision of 49 CFR).

Division 1.1 Explosives are explosives that have a mass explosion hazard. A mass explosion is one that affects almost the entire load instantaneously.

Division 1.2 Explosives are explosives that have a projection hazard, but not a mass explosion hazard.

Division 1.3 Explosives are explosives that have a fire hazard and either a minor blast hazard or a minor projection hazard or both, but not a mass explosion hazard.

Division 1.4 Explosives are explosives that present a minor explosion hazard. The explosive effects are largely confined to the package and no projection of fragments of appreciable size or range would be expected. An external fire must not cause virtually instantaneous explosion of almost the entire contents of the package.

Division 1.5 Blasting Agents are very insensitive explosives. This division comprises substances that have a mass explosion hazard but are so insensitive that there is very little probability of initiation or of transition from burning to detonation under normal conditions of transport.

Division 1.6 Explosives are extremely insensitive articles that do not have a mass explosion hazard. This division comprises articles that contain only extremely insensitive detonating substances and that demonstrate a negligible probability of accidental initiation or propagation.

Specific authorization and training are required to transport explosives. Transportation at each site requires individual authorization. Only CMGRAMS and Site 300 Procurement & Materiel Department MDD personnel may transport explosives offsite.

4.15.1.3 *Nonhazardous Materials*

The Central Stores, Building 411, is located in the southeast quadrant of the Livermore Site. This 69,505-gross-square-foot building is managed by the Procurement and Materiel Department and handles all onsite receiving and temporary storage and offsite shipment of materials to Site 300. Material deliveries (nonhazardous, hazardous, and radioactive) are received and sorted and then forwarded to the requesting program. Only standard (nonhazardous) supply items are placed in the storage area in Building 411, and program representatives may obtain needed material from Central Stores.

For Site 300, no central storage facility is currently in operation. Materials are shipped from the Livermore Site directly to the user facility at Site 300.

4.15.1.4 *Decontamination of Equipment and Facilities*

At LLNL, decontamination of equipment and facilities must be done in accordance with LLNL safety procedures that are based on DOE orders and other Federal and State of California laws and guidelines. It is also the policy of LLNL that decontamination of equipment must be managed in a safe manner to ensure the protection of employees.

Decontamination of equipment is done at the facility where the equipment is located, provided that no hazardous waste treatment is performed as part of this process. Equipment that cannot be decontaminated is reduced in size, if necessary, and disposed of through waste management procedures. Size reduction for large pieces of equipment (e.g., gloveboxes, pumps, machining tools, and tanks) contaminated with hazardous and/or mixed waste or hazardous chemical constituents can be done in Building 612. These pieces of equipment may be vacuumed, wiped down, or steam cleaned to remove residual contaminants. The equipment is then dismantled using a cutoff saw, or is taken apart with hand tools. Contaminated areas of equipment exposed during dismantling are vacuumed or wiped down. Equipment contaminated with transuranic (TRU) radionuclides, such as plutonium, is not decontaminated; when removed from service, the equipment is managed as TRU waste.

4.15.1.5 *Excess Properties Salvage and Reclamation*

LLNL follows a process for the disposal of excess equipment through a policy of making this property available for other needs at the site, to other Federal and state agencies, or for sale to reduce the cost of LLNL operations. The LLNL custodian is responsible for providing an explanation of the condition of the item on an excess equipment card and making arrangements for delivery of the items to storage, excess, or recycling.

The equipment custodian (with support from several organizations) is responsible for screening, reusing, and disposing of items declared excess to the needs of LLNL.

The excess and recycling operations use approximately 25,500 gross square feet of covered space.

4.15.2 Waste Management

This section describes the regulatory setting, waste generation, waste management practices, and treatment/storage facilities at LLNL and offsite disposal of waste. For a brief discussion on pollution prevention and waste minimization, see Section 4.14.5, with an expanded discussion in Appendix B. The waste generation rates (1993 to 2002) presented in this section represent actual data based on NNSA and LLNL records (see Appendix B). Because multiple organizations generate and manage waste at the two sites, with a high degree of integration, the term LLNL includes the Livermore Site and Site 300, unless otherwise specified. Further, because multiple organizations, including plant engineering; the Chemistry and Material Sciences Directorate; and the Safety and Environmental Protection Directorate, manage waste facilities at LLNL, the term RHWH includes all waste management facilities, unless otherwise specified.

Waste management activities consist of managing, treating, storing, and preparing for offsite disposal of all wastes in accordance with applicable Federal and state regulations, permits obtained under these regulations, and DOE orders. The waste categories routinely generated onsite under normal operations include radioactive waste (low-level waste [LLW], mixed low-level waste [MLLW], and TRU waste); hazardous waste, which includes *Resource Conservation and Recovery Act* (RCRA) hazardous (chemical and explosives) waste; state-regulated waste; TSCA waste (primarily asbestos, PCBs, and biohazardous [medical] waste); nonhazardous solid waste; and process wastewater. Figure 4.15.2–1 shows locations of the Decontamination and Waste Treatment Facility (DWTF) and other RHWM facilities.

Generally, wastes generated at individual buildings are accumulated at the point of generation in satellite accumulation areas. Generators, with support from RHWM staff, must segregate, identify, characterize, separate, package, label, document, and transfer waste to designated waste accumulation areas (LLNL 2002n). These wastes (with the exception of medical waste) are then transferred to waste accumulation areas where hazardous and mixed wastes may be stored for up to 90 days. Wastes are collected from waste accumulation areas or retention tanks by hazardous waste technicians. The wastes are either transferred to onsite waste management facilities for treatment, storage, and/or preparation for offsite disposal or to various offsite permitted treatment, storage, and disposal facilities. Some LLW and all TRU radioactive wastes are currently being stored awaiting shipment to the Nevada Test Site, the Waste Isolation Pilot Plant, or another DOE-approved facility for storage or disposal. LLNL legacy mixed wastes are being managed in accordance with the *Federal Facility Compliance Act* Site Treatment Plan. Medical wastes are typically collected at the generator facility before being treated onsite or shipped offsite for treatment and disposal.

Table 4.15.2–1 lists the waste management facilities at LLNL, including maximum inventory quantities. Table 4.15.2–1 includes information on the facility type and waste types managed. Most facilities manage both radioactive and hazardous wastes. However, certain facilities are restricted to only one waste type (for example the Explosive Waste Treatment Facility). The DWTF, Area 612, and Area 514 are the primary waste management facilities. Appendix B describes these facilities in detail.

Normal (Routine) Operations

The affected environment considered in this LLNL SW/SPEIS is limited to those facilities that generate waste under normal (routine) operations at LLNL. Normal operations encompass all current operations that are required to maintain R&D at LLNL facilities.

New Operations

Several new operations are currently in the planning stages at LLNL. However, they are considered outside of the scope of the current affected environment description for this LLNL SW/SPEIS because they have not yet reached operational status. New operations are defined as programmatically planned projects with defined implementation schedules that will take place in the future. Two facilities, the NIF and BioSafety Level (BSL)-3 Laboratory, are examples of these new operations and have had separate NEPA evaluations.

Special (Nonroutine) Projects

Special (nonroutine) projects are limited-duration projects, such as construction, that are considered separately from facility operations. These projects can make a large contribution to the overall waste generation activities at LLNL. Three areas are considered special projects: construction, decontamination and decommissioning (D&D), and environmental restoration. The wastes generated from these areas are identified as nonroutine. Typically, the projects are well defined to allow waste management activities to directly support the project.

For several years, excess facility management activities have been underway to remove legacy facilities, material, and equipment from the site. This effort has removed over 260,000 square feet of facility space (LLNL 2002dm). One hundred and sixty-one buildings, accounting for approximately 700,000 gross square feet (an estimated 46,000 tons of construction debris), are potentially scheduled for removal. As much as 99 percent of the construction debris would be diverted wastes and recoverable assets (LLNL 2003bd). Future space reduction at LLNL will focus on buildings that are beyond their useful lives. These buildings will become vacant after new buildings are built. Twenty-three buildings, accounting for 53,500 gross square feet, are categorized as being in poor condition, beyond their useful life (LLNL 2002dm).

Waste Categories

Low-Level Waste (LLW)—LLW is waste that contains radioactivity and is not classified as high-level waste, TRU waste, or spent nuclear fuel or byproduct tailings containing uranium or thorium from processed ore (as defined in Section 11[e][2] of the *Atomic Energy Act* [42 U.S.C. §2011]). Test specimens of fissionable material, irradiated for research and development only and not for the production of power or plutonium, may be classified as LLW, if the concentration of transuranic is less than 100 nanocuries per gram.

Mixed Low-Level Waste (MLLW)—MMLW is waste that contains both hazardous waste, regulated under RCRA, and low-level waste.

Transuranic Waste (TRU)— TRU waste is waste containing more than 100 nanocuries of alpha-emitting TRU isotopes per gram of waste, with a half-life greater than 20 years, except for high-level radioactive waste. TRU waste is waste that the DOE Secretary has determined, with concurrence of the Administrator of EPA, does not need the degree of isolation required by the disposal regulations or waste that the U.S. Nuclear Regulatory Commission has approved for disposal on a case-by-case basis in accordance with 10 CFR Part 61.

Mixed Transuranic Waste (Mixed TRU)—Mixed TRU waste contains both hazardous wastes, regulated under the RCRA, and TRU waste.

RCRA Hazardous Waste—RCRA hazardous waste is any solid waste (definition includes semisolid, liquid, or gaseous material) listed in Subpart D of 40 CFR Part 261 or having the characteristics of ignitability, corrosivity, toxicity, or reactivity, as defined by RCRA.

LLNL Hazardous Waste—LLNL hazardous waste includes RCRA hazardous waste, state-regulated waste, TSCA waste, and biohazardous waste.

TSCA Waste—TSCA waste contains materials exceeding identified limits in TSCA. LLNL manages two TSCA-regulated materials: PCBs and asbestos.

Sanitary Solid Waste—Sanitary solid waste includes nonhazardous office and laboratory trash.

Building debris estimates associated with D&D projects are included in the assessments of the waste generated from existing operations (potentially 53,000 tons of debris). However, separate NEPA review may be required in the future depending on the scale and extent of the work involved.

This LLNL SW/SPEIS considers environmental restoration activities as nonroutine operations due in part to the fluctuation of year-to-year waste quantities. To comply with CERCLA groundwater remedial actions at the Livermore Site, Environmental Restoration Division (ERD) has designed, constructed, and operated 5 fixed groundwater treatment facilities and associated pipeline networks and wells, 20 portable groundwater treatment units, 2 catalytic dehalogenation units, and 3 soil vapor extraction facilities (see Appendix B), to date. In 2001, ERD operated 4 fixed, 19 portable, 2 catalytic reductive dehalogenation, and 2 soil vapor treatment units. ERD also installed an electro-osmosis system to improve its ability to remove contaminants from fine-grained sediments.

At Site 300, ERD has designed, constructed, and operated 3 soil vapor extraction facilities and 11 groundwater extraction and treatment facilities. In addition, ERD has capped and closed four landfills and the High Explosives Rinse Water Lagoons and Burn Pits, excavated and closed numerous wastewater disposal sumps, and removed contaminated waste and soil to prevent further impacts to groundwater at Site 300.

The environmental restoration program also generates soil, personal protective equipment, and sampling tools during soil boring, well installation, equipment maintenance (filters, pumps, tubing), and trenching activities. The quantities of waste generated are highly variable depending on the purpose of the activity. The quantities are characterized within the nonroutine quantities presented in Section 4.15.2.2.

4.15.2.1 *Regulatory Setting*

Management of hazardous, radioactive, mixed, and medical wastes generated at LLNL is pursuant to applicable DOE orders and Federal, state, and local laws and regulations. LLNL waste management programs implement site-wide plans and operating practices to comply with permits and other regulatory requirements. LLNL operates under three RCRA Part B permits (one for the Livermore Site and two for Site 300). Inspections and findings of the Livermore Site and Site 300 by external agencies in 2001 are listed in Table 4.15.2.1–1. A summary of permitting activities is presented in Table 4.15.2.1–2. Major laws, regulations, and orders are summarized in Table 4.15.2.1–3.

TABLE 4.15.2.1–3.—*Summary of Major Laws, Regulations, and Orders Relevant to Waste Management (continued)*

Laws, Regulations, and Orders	Description
Medical Waste Management Act (California Health and Safety Code § 117600-11860)	The *Medical Waste Management Act* establishes a comprehensive program for regulating the management, transport, and treatment of medical wastes that contain substances that may potentially infect humans.
40 CFR Part 260 Series	The implementing regulations established by EPA governing hazardous waste.
California Code of Regulations, Title 22	The implementing regulations established by Cal-EPA for management of hazardous waste.
DOE O 435.1, "Radioactive Waste Management"	DOE O 435.1 establishes the policies, guidelines, and minimum requirements by which DOE and its contractors manage radioactive waste, mixed waste, and contaminated facilities. This order establishes DOE policy that radioactive and mixed wastes be managed in a manner that ensures protection of the health and safety of the public, DOE, contractor employees, and the environment. In addition, the generation, treatment, storage, transportation, and disposal of radioactive wastes, and the other pollutants or hazardous substances they contain, must be accomplished in a manner that minimizes the generation of such wastes across program office functions and complies with all applicable Federal, state, and local environmental, safety, and health laws and regulations and DOE requirements.
DOE O 450.1, "Environmental Protection Program"	This order directs facilities to implement sound stewardship practices that are protective of the air, water, land, and other natural and cultural resources impacted by DOE operations and by which DOE cost-effectively meets or exceeds compliance with applicable environmental, public health, and resource protection laws, regulations, and DOE requirements.

Source: LLNL 2002cc.

4.15.2.2 *Radioactive Waste*

Radioactive waste generated at LLNL includes LLW, MLLW, TRU waste, and mixed TRU waste. LLNL does not manage or generate high-level waste (a highly radioactive material that results from the reprocessing of spent nuclear fuel). LLW, MLLW, and TRU waste are produced primarily in laboratory experiments and component tests. Mixed wastes are discussed in Section 4.15.2.4. See Appendix B for a detailed description of radioactive waste, storage quantities, and treatment quantities.

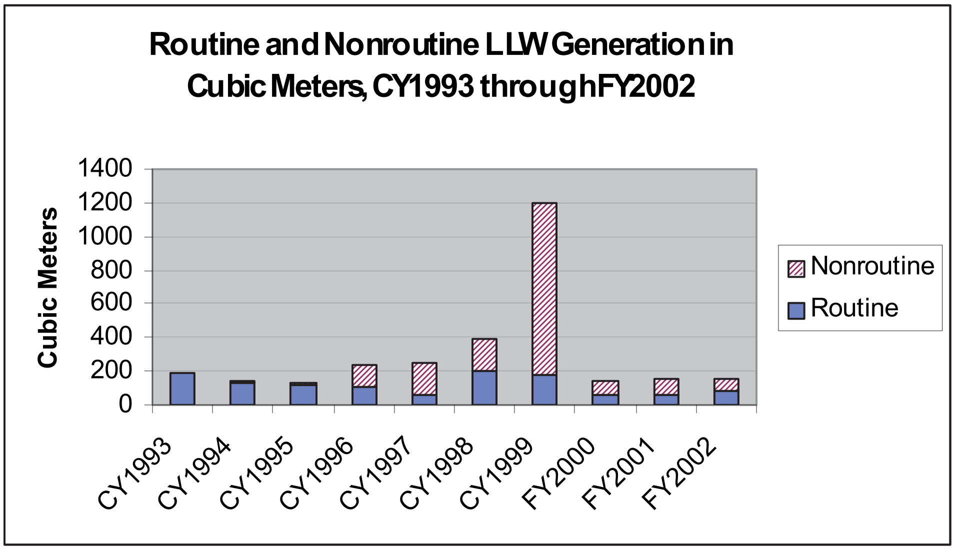
DOE O 435.1 permits onsite storage of LLW and TRU wastes until appropriate disposal becomes available. Currently, there are no regulatory restrictions on the length of time this waste may be stored onsite, provided that disposal or offsite storage options are being pursued and the waste is stored in accordance with all applicable regulations. LLNL maintains the capability to treat solid radioactive wastes onsite. LLNL has treated liquid radioactive wastes at the Area 514 Tank Farm. The DWTF is replacing Area 514 (LLNL 2002ca). LLNL disposes of solid LLW offsite at the Nevada Test Site. Available storage space for LLW and TRU waste is limited by exposure considerations (i.e., radiation exposure to personnel) at a given storage location. However, radioactive wastes, unlike RCRA-regulated wastes, can be stored at various locations onsite provided that the wastes are properly packaged, labeled, and monitored. Radioactive waste management facilities are listed in Table 4.15.2–1.

As part of the effort to minimize the total quantity of radioactive waste that is generated at LLNL, facilities that generate this type of waste are designated as a Radioactive Materials

Management Area (RMMA). An RMMA is an area where a reasonable potential exists for contamination due to the presence of unconfined or unencapsulated radioactive material or an area that is exposed to sources of radioactive particles (such as neutrons and protons) capable of causing activation. Managers of facilities must document the location of all RMMAs. Procedures to minimize the generation of radioactive wastes are then developed.

Historic and Current Radioactive Waste Generation

Radioactive waste has historically been generated from R&D activities that used radioactive materials. Figure 4.15.2.2–1 summarizes historic routine and nonroutine LLW quantities generated onsite from calendar years (CYs) 1993 through fiscal year (FY) 2002. Annual routine TRU waste generation ranged from 0 to 12 cubic meters. Annual nonroutine TRU waste was 0 cubic meters, with the exception of 10 cubic meters in 1995.



Source: DOE 2002s.

FIGURE 4.15.2.2–1.—*Routine and Nonroutine Waste Generation*

4.15.2.3 *Hazardous Waste*

Hazardous waste refers specifically to nonradioactive waste, including RCRA chemical and explosives waste, state-regulated hazardous waste, biohazardous (for this document medical is included) waste, and TSCA waste (primarily asbestos and PCBs). Almost all buildings at LLNL generate hazardous wastes, ranging from common household items such as fluorescent light bulbs, batteries, and lead-based paint to solvents, metals, cyanides, toxic organics, pesticides, asbestos, and PCBs.

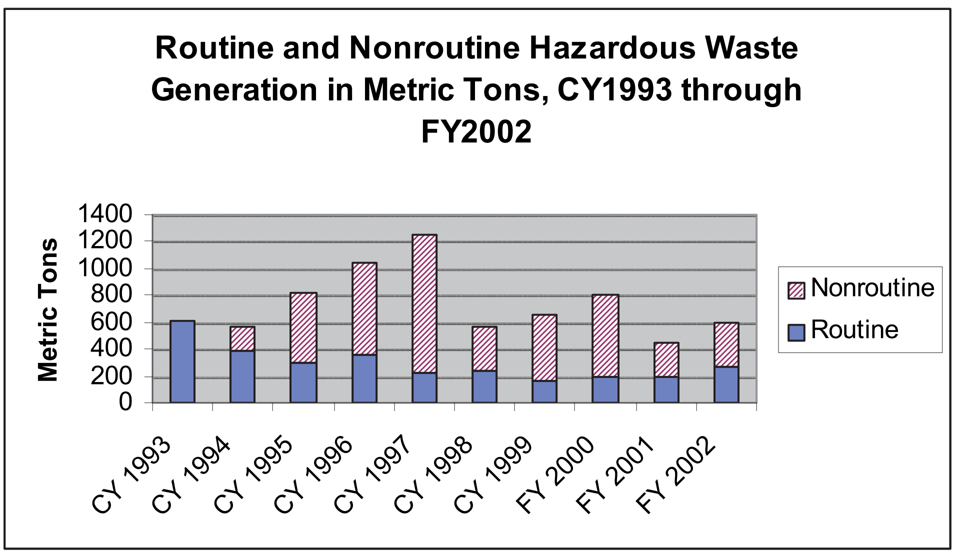
RCRA allows onsite management of hazardous waste at the point of generation or in designated waste accumulation areas or storage in permitted storage facilities. There are regulatory restrictions on the length of time that waste may be stored onsite and it must be stored in accordance with all applicable regulations. LLNL does maintain the capability to treat certain hazardous wastes onsite. LLNL treats explosive wastes at Site 300. Except for empty-container crushing, hazardous wastes are usually not treated before offsite shipment to a licensed treatment, storage, and disposal facility. Hazardous wastes are shipped offsite through licensed commercial transporters to various permitted treatment, storage, and disposal facilities. See Appendix B for a more detailed description of hazardous waste-related topics.

Historic and Current Hazardous Waste Generation

The hazardous waste generated at LLNL is predominantly chemical laboratory trash generated from experiments, tests, other R&D activities, and infrastructure fabrication and maintenance. Figure 4.15.2.3–1 illustrates the quantities of routine and nonroutine hazardous waste generated for all operations from CY1993 through FY2001. From CY1993 to FY2002, annual total (routine plus nonroutine) RCRA hazardous waste generation ranged from 126 to 514 metric tons. During the same period, total annual state-regulated and total annual TSCA waste ranged from 155 to 723 metric tons and 9 to 515 metric tons, respectively.

Explosive Waste

The explosive waste generated at LLNL ranges from explosives and analytical chemicals to wastewater contaminated with explosives. In 2002, 6,000 pounds of explosive waste were managed. Waste explosives are treated at the EWTF (approximately 2,700 pounds in 2002). For further details, see Appendix B.

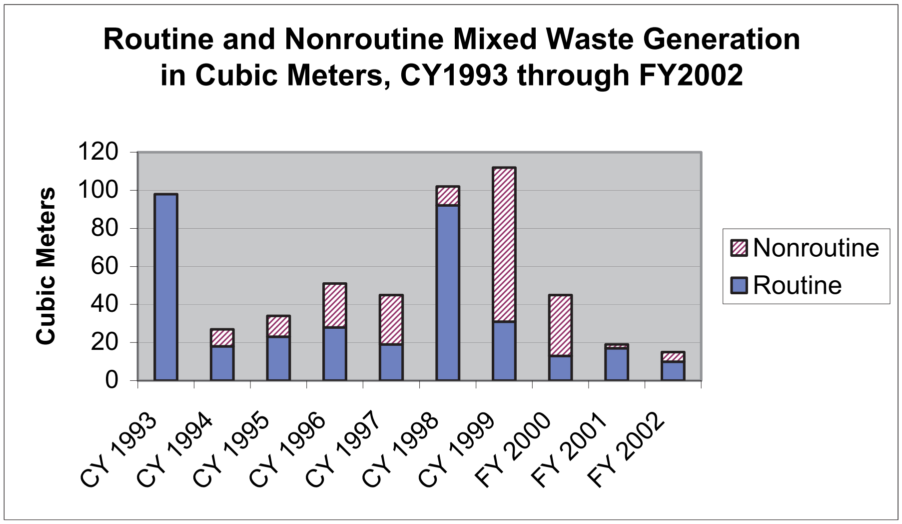


Source: DOE 2002s.

FIGURE 4.15.2.3–1.—*Routine and Nonroutine Hazardous Waste Generation*

4.15.2.4 *Mixed Wastes*

MLLW and mixed TRU waste are produced primarily in laboratory experiments and component tests. Figure 4.15.2.4–1 illustrates the quantities of MLLW generated from CY1993 through FY2002. Mixed TSCA waste is produced primarily during D&D and environmental restoration activities. Most years, LLNL does not generate mixed TRU and mixed TSCA waste; however, one or more metric tons are possible in any given year.



Source: DOE 2002s.

FIGURE 4.15.2.4–1.—*Routine and Nonroutine Mixed Waste Generation*

LLNL does not maintain the capability to treat or dispose of solid mixed wastes onsite. In the past, LLNL treated liquid mixed wastes at the Area 514 Tank Farm (LLNL 2002p). The DWTF is designed to replace Area 514. LLNL treats and disposes MLLW offsite under the Federal Facility Compliance Order issued to DOE and requires DOE to direct the University of California, Davis (current operator), to comply fully (LLNL 2002cc, DOE 1997g). LLNL is continuing to work with DOE to maintain compliance with the *Federal Facilities Compliance Act* Site Treatment Plan (STP) for LLNL that was signed in February 1997 (DOE 1997g). All milestones for 2001 were completed on time. Reports and certification letters were submitted to DOE as required. An agreement was reached with DTSC to extend all FY2002 and FY2003 milestones to allow LLNL to concentrate resources on characterizing and disposing of mixed TRU waste. LLNL continued to pursue the use of commercial treatment and disposal facilities that are permitted to accept mixed waste. These facilities provide LLNL greater flexibility in pursuing the goals and milestones set forth in the Site Treatment Plan.

4.15.2.5 *Biohazardous Wastes*

Division 104, Part 14, Sections 117600-118360 of the California Health and Safety Code is known as the *California Medical Waste Management Act*. This Act is a comprehensive program for regulating the management, transport, and treatment of medical wastes. The California Department of Health Services (known as DHS) administers the *California Medical Waste Management Act* and has given authority to Alameda County Health Care Services Agency to oversee LLNL’s medical waste management practices.

The Livermore Site is considered a large-quantity generator of medical waste, which means that 200 or more pounds of medical waste are generated in any month of a 12-month period. Therefore, the Livermore Site is subject to annual inspections conducted by Alameda County, annual waste generator/treatment permit fees, and maintenance of the Medical Waste Management Plan that contains emergency plans for each program at LLNL that generates and treats medical waste.

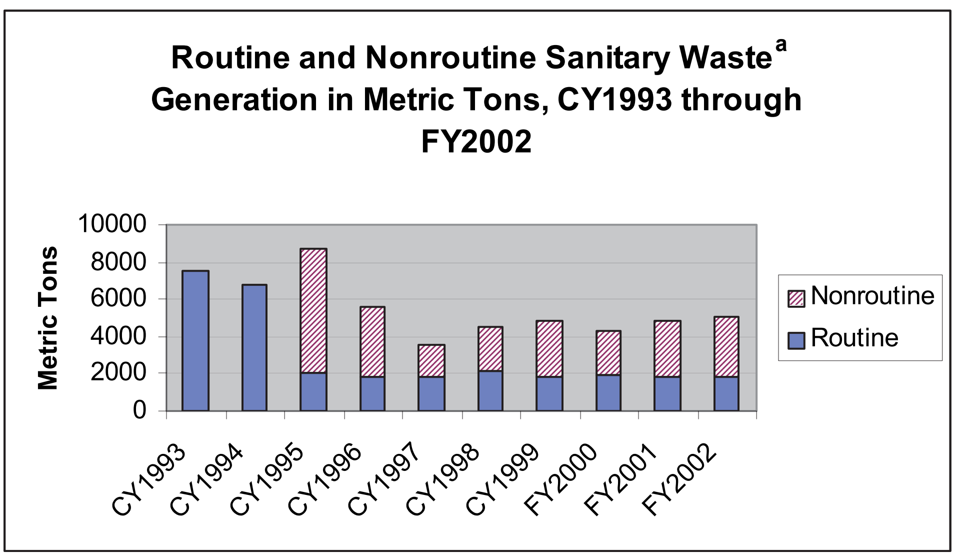
Medical waste plus hazardous waste is designated as hazardous waste and is subject to regulation as specified in the statutes and regulations applicable to hazardous waste. Medical waste plus radioactive waste is designated as radioactive waste and is subject to regulation as specified in the statutes and regulations applicable to radioactive waste.

Site 300 is considered a small-quantity generator of medical waste, which means that less than 200 pounds of medical waste is generated per month. Therefore, Site 300 is not subject to medical waste generator and treatment permit fees and is not subject to annual inspections by San Joaquin County. Site 300 does, however, submit a minimal annual fee for a Limited Quantity Hauling Exemption, which allows registered LLNL haulers to transport medical waste generated at Site 300 to the Livermore Site for waste consolidation prior to offsite shipment.

4.15.2.6 *Other Wastes*

Sanitary Solid Waste

Routine sanitary solid waste consists predominantly of office and laboratory nonhazardous trash. Nonroutine sanitary solid waste consists predominately of nonhazardous building debris generated from major construction and D&D activities. All solid waste from the Livermore Site is currently disposed of at the Altamont Landfill in Livermore, California or diverted for recycling (see Appendix O). The Altamont Landfill has a remaining capacity of approximately 15 million cubic yards (over 10 years) (CIWMB 2002). There are two active landfills in San Joaquin County that have over 10 years of capacity. Figure 4.15.2.6–1 summarizes historic sanitary solid waste quantities generated onsite from CY1993 through FY2002 showing portions of routine and nonroutine generated each year with the exception of CY1993 and CY1994. In FY2001 and FY2002, LLNL generated 1,900 and 1,800 metric tons of routine sanitary waste each year and 3,000 and 3,300 metric tons of nonroutine sanitary waste, respectively (DOE 2002s).



Source: DOE 2002s.
[a] Nonroutine quantities included in routine total for CY1993 and CY1994.

FIGURE 4.15.2.6–1.—*Sanitary Waste Generation in Metric Tons*

Environmental Restoration Wastes

For a discussion of onsite contamination, placement on the National Priorities List (NPL), and the nature and extent of contamination, see Section 4.17. A general discussion of treatment is provided below.

Current activities include 30 treatment facilities; there are 28 groundwater treatment facilities and 2 vapor treatment facilities. Eighty-four groundwater extraction wells operated at an average flow rate of 2,540 liters per minute. Two vapor extraction wells operated at an average flow rate of 0.27 cubic meters per minute. Table 4.15.2.6–1 presents the treatment area and VOCs removed from groundwater and soil at the Livermore Site. Table 4.15.2.6–2 summarizes FY2002 and cumulative totals of volumes and masses of contaminants removed from groundwater and soil vapor at Site 300.

Other environmental restoration wastes (soil, personal protective equipment, sampling tools) are rolled into nonroutine radioactive, hazardous, and sanitary solid waste categories previously discussed.

TABLE 4.15.2.6–1.—*Volatile Organic Compounds Removed From Groundwater and Soil at the Livermore Site*

		2002		Cumulative Total	
Treatment Area	**Startup Date**	**Water Treated (million liters)**	**VOCs Removed (kilograms)**	**Water Treated (million liters)**	**VOCs Removed (kilograms)**
TFA	1989	251.4	5.7	3,658	154
TFB	1990	130.2	6.1	787	54.2
TFC	1993	107.9	7.1	595	53.9
TFD	1994	281.3	68.4	1,505	500
TFE	1996	110.5	17.5	544	139
TFG	1996	12.1	0.7	70.4	3.7
TF406	1996	40.5	1.0	211	7.7
TF518	1998	4.9	0.6	37.1	4.3
TF5475	1998	0.72	0.7	2.3	4.8
		Soil Vapor Treated (thousand cubic meters)	**VOCs Removed (kilograms)**	**Soil Vapor Treated (thousand cubic meters)**	**VOCs Removed (kilograms)**
VTF518	1995	0	0	425	153
VTF5475	1999	143.5	37.7	659	306

Source: LLNL 2003l.
TF = Treatment Facility; VOC = volatile organic compound; VTF = Vapor Treatment Facility.

Industrial Wastewater

Industrial wastewater is waste that contains constituents at concentrations too high to allow discharge to the sanitary sewer but does not meet the criteria to be designated as hazardous waste. The majority of wastewater is treated and discharged to the sanitary sewer. Several thousand gallons of wastewater are routinely held pending analysis. After treatment, the wastewater is discharged to the sanitary sewer if discharge criteria are met. For additional information, see Section 4.11.

At Site 300, Buildings 801, 806, 807, 809, 825, and 826 process nonhazardous wastewater through several steps (e.g., filters) into Class II surface impoundments (LLNL 2002cc, LLNL 2000a, LLNL 1999d).

TABLE 4.15.2.6–2.—*Volatile Organic Compounds Removed From Groundwater and Soil Vapor at Site 300*

Treatment Area	Startup Date	2002 Water Treated (million liters)	2002 VOCs Removed (kilograms)	Cumulative Total Water Treated (million liters)	Cumulative Total Volatile Organic Compounds Removed (kilograms)
GSA-Eastern GWTF	1991	78.7	0.17	806.6	6.19
GSA-Central GWTF	1993	4.19	0.59	29.16	10.66
Building 834	1995	0.11	0.81	0.93	31.84
High Explosives Process Area	1999	4.5	0.012	10.5	0.058
Building 832	1999	1.90	0.12	5.68	0.44
Building 854	1999	3.67	0.78	12.25	6.14
Pit 6	1998	Not Applicable	Not Applicable	0.268	0.0014
		Soil Vapor Treated (thousand cubic meters)	**Volatile Organic Compounds Removed (kilograms)**	**Soil Vapor Treated (thousand cubic meters)**	**Volatile Organic Compounds Removed (kilograms)**
GSA-Central	1994	293.58	1.54	1,987.18	66.16
Building 834	1998	406.18	5.19	1,657.56	108.26
Building 832	1999	96.2	0.28	282.5	1.39

Source: LLNL 2003l.
GSA = general services area; GWTF = groundwater treatment facility; VOC = volatile organic compound.

Sanitary (Domestic) Wastewater

Liquid effluents with contaminants below limits specified by the city of Livermore are released to the city of Livermore sewer system. In FY2002, LLNL discharged approximately 240,000 gallons per day (LLNL 2002l). The sewer system capacity is approximately 1,685,000 gallons per day (LLNL 2002dm). In FY2001, Site 300 (GSA) generated approximately 2,100 gallons per day (LLNL 2002cc, LLNL 2000a, LLNL 1999d). Site 300 remote facilities use septic systems.